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Emma L. Dewberry
BSc.(Hons)

A thesis submitted to The Open
University in partial fulfilment of the
requirements for the degree of
Doctor of Philosophy

The Design Discipline
Technology Faculty

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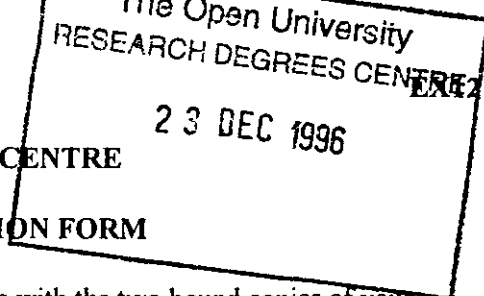
Unless we change the direction in which we are headed, we might end up where we are going

Chinese Proverb

We are very far from having a design culture which helps us cope with the complexity of reality We have witnessed a crisis in the hedonistic attitudes prevalent during the eighties Now in the nineties people are beginning to express a need for ethical reference. Even the environmental crisis, while it presents such a threat, can also be seen as an opportunity to create a new culture. The designer's specific role is not only the technological aspect of ecological design - the ability to recycle - but also to imagine new scenarios, with new criteria for a new quality of life which is suitable for the environment, acceptable to society and attractive to our culture.

Ezio Manzini (Design 1990, No.501, 9)

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Abstract

Environmental degradation and concepts of 'sustainability' have recently become a focus of political, commercial and social concern. This thesis addresses one of the issues concerning human impact on the environment, namely the environmental awareness and action of those involved with design and development. This project provides an overview of designers' current attitudes to environmentally responsible design and investigates design that is perceived to be more environmentally responsible.

The research was exploratory and qualitative in nature. The postal and telephone pilot surveys and the main study of 20 in-depth interviews were carried out with individuals involved in design and development in design consultancies and a range of design-based manufacturing companies within the UK.

It was found that most designers were unaware of many of the issues surrounding environmentally responsible design. Few companies were including environmental criteria within design and development processes, the exceptions generally responding to legislative or market demands. Three main levels of environmentally responsible design are discussed in this project; *green design* addresses a focus on one or two environmental impacts of a product, *ecodesign* refers to a comprehensive product lifecycle design strategy, and *sustainable design* describes a move beyond the current context of design and questions, for example, the need, value, and ethics of a product's development.

The significant qualitative data gathered during the project led to the development of a visual analysis method, the 'Environmental footprint'. Different types of business approach (proactive, reactive and cynical) to incorporating environmental issues within product development emerged from this analysis. These were further developed into a hierarchy of environmental business strategies which aided the identification of approaches that relied on 'bottom-up' action (e.g., action of an individual 'environmental champion' within the company), and those which tended to be a result of 'top-down' action (e.g., a company's strategic environmental policy).

The research showed that to achieve effective, long-term environmentally responsible design and development the following are desirable: (a) design-specific information on environmentally responsible design, (b) effective communication channels within companies and throughout the supply chain, and (c) greater understanding of the qualities and scope of design by senior management.

The research also questions how a design profession focused almost entirely on increasing the production and consumption of goods can re-evaluate its role in society and move towards a more responsible and environmentally sustainable existence. 'Sustainable design' is discussed as a concept which moves beyond 'green design' and 'ecodesign', and hence the remit of the designer, to one which can only be successfully addressed by a change in the political and economic global development system.

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ECODESIGN

Chapter 1

An Introduction to the Thesis

1.1 Introduction

This chapter aims to provide an introduction to the area of the research study and an overview of the thesis structure. The focus of research is the design of environmentally benign products; the project aims to analyse UK designer's attitudes to the integration of environmental criteria within design and development process and review industry projects that have focused on this issue. The chapter begins by justifying this area of research and presents an introduction to the concept of ecodesign. The research aims and objectives are then presented with the final section of the chapter outlining the structure of the thesis.

1.2 The focus of the thesis

The thesis focuses on UK design attitudes to integrating ecodesign philosophies within design and development processes. The research has analysed existing approaches to integrating a more environmentally aware perspective within design projects and has looked at the barriers and opportunities for the effective integration of these new criteria from a design perspective.

Although there is an existing body of knowledge on design processes, design and development and environmental science as independent areas of study, there has been very little work published on an amalgamation of these subject areas. The origins of ecodesign stem from the body of 'alternative lifestyle' literature of the 1960's and 1970's. In the mid 1980's there was a revival in interest in the subject of 'greening' design processes and limited research has been completed in this area. There has been no published work on ecodesign in relation to existing UK design practices and the attitudes and action of UK based designers. In this respect, this thesis can be regarded as a new area of research.

The research will be grounded in the UK design-based industry. Due to the newness of the research area there is a need to develop an understanding of design processes that include

environmental criteria within the context of business organisations. The research primarily focuses on the attitudes of practising designers to the concept of integrating a more environmentally aware perspective within design development; it focuses on information requirements for designers and on understanding the relationships between designers, management and other players in the supply chain

The research is exploratory in nature and aims to understand the concept of a better, more environmentally aware design and development process; one which is directly related to designers and their current and future requirements to ensure that ecodesign becomes a reality.

1.3 An introduction to the issues surrounding ecodesign

Environmentally responsible design is not a new area of design; it was introduced in the 1960's by designers such as Papanek and Bonseipe as a reaction to the over-styled and consumerist perspective that design -and especially industrial design - had taken, particularly in the USA.

Concepts of environmental awareness in design had been present before the 1960's; social and ecological principles had been tackled by designers such as William Morris in the late nineteenth century, and Frank Lloyd Wright in the early twentieth century. These are individuals associated with Western, developed design approaches. It must not be forgotten that for centuries the indigenous populations of the world have been actively practising ecological design; in the design of their buildings and artefacts both useful and decorative. Such peoples have utilised local materials that are renewable, that have empathy with the natural environment and designed objects which are respected and valued and have longevity. To a large extent, environmentally responsible design ideas represent a return to these values.

Definitions of environmentally responsible design (green design; ecodesign; sustainable design) are presented in Chapter Two, 2.6.1

Several individuals argue that the environmental impact of human activity is so great that simply to minimise environmental damage would not affect the overall environmental devastation caused by man; in order to move towards a more sustainable future radical changes in lifestyle are needed.(Meadows D. et al, 1972 ; Schmidheiny S., 1992)

Manzini (1994), for example, says that consumption must be reduced by a factor of 20 in the next 30 years or so, for environmental sustainability to be an achievable goal. In this context it is important to focus on product design development because the production of consumer

goods adds dramatically to the proliferation of unnecessary and disposable products that are produced annually. A greening of product design could help pave the way towards more radical changes in the products available on the market. In the short-term, products can be redesigned to have less impact on the environment (green design -> ecodesign). However, in the longer-term further reduction of the environmental impact can be made by educating people to make informed decisions regarding the type and amount of products they buy (sustainable design).

Reducing the amount consumed by populations in the developed nations will aid the development of a more sustainable, more ethically, socially and environmentally aware society. This will require a massive re-education process and a dramatic change in the lifestyles of a large proportion of the 'consuming' nations. The long-term availability of resources must be a priority within production and consumption cycles where material and natural resources and energy sources are respected and used efficiently; where they are optimised in production, use and disposal of products and systems. (Packard V., 1960; Papanek V., 1983, 1985 & 1995)

Design is a central focus of production systems. Major environmental decisions are taken regarding the environmental impacts of a product (or system) at the initial stages of the product development process - 80% of the environmental impacts of a product are committed in the first 20% of design time (McAloon 1996). Environmental impacts of products and systems should thus be reduced dramatically by integrating a more environmentally aware design process within business organisations. This increased environmental awareness within business sectors will help to support the more long-term concept of sustainable development.

1.3.1 Areas for investigation

Given the importance of the role design has to play within the 'greening' of production systems, it is important to develop an effective method of introducing the new criteria into existing design processes. It is vital to understand the information requirements of designers and others involved in the design and development process. It is also necessary to form an understanding of the designer profile, design management and the design process. It was felt appropriate for the research to focus on a design perspective for the primary research; in many cases similar research has focused solely on managers whose design knowledge is limited and lacks an intimate understanding of the mechanisms involved in the design process. Integrating ecodesign philosophies requires an intimate knowledge of design thinking and design priorities and therefore it was felt that designers were the best group of individuals to focus on within business organisations.

The concept of ‘better’ ecodesign practice rather than ‘best’ ecodesign practice has been central in developing the primary research. The pilot surveys suggested that ‘best’ ecodesign practice in the UK was some way off and so the main research aimed to focus on those organisations who perceived themselves to be aware of the issues and actively introducing some form of environmental perspective within their design and development processes.

The results of both the secondary and primary research surveys will aim to add to the understanding of the complexity of introducing an environmental perspective within design-based industries. No such work has so far been completed on the attitudes and practices regarding ecodesign of UK design professionals. The research results will indicate the level of UK ecodesign understanding compared to that developed in other countries through primarily research projects, for example, The Netherlands - projects at Delft University, TNO; this may add to supporting the concept that ecodesign information and the ecodesign process is basically generic in nature and can transcend boundaries of language, culture and geographical location.

Due to the exploratory nature of the research project, a primarily qualitative approach has been adopted for the research process in preference to a more rigid and structured research approach. It is hoped that this method will provide depth and insight into the effective implementation of environmental criteria within design and development processes.

1.4 Research aims & research objectives

1.4.1 Research aims

The overall aim of the thesis is to provide an understanding of the issues involved in *integrating effective ecodesign processes within UK design-based industry. It will aim to produce an in-depth understanding of the barriers and opportunities for introducing environmental criteria into design; of information requirements for designers; of changes in the design process; of attitudes of practising designers to the subject area, and an understanding of possible future directions for design.*

The thesis is divided into three sections:-

- **A Literature Review** - to provide a comprehensive overview of the subject and related subject areas which will direct the nature of the primary research.

- **A Pilot Study** - the main aim of this is to help formulate the research questions for the main study by presenting an overview of current attitude and action of UK designers; it guides the direction of the rest of the research.
- **A Main Study** - building upon the first two sections of research. This main research study aims to identify and conduct suitable case studies within design-based industry and the design consultancy profession to gain an in-depth view of more environmentally aware design practices.

1.4.2 Research objectives

- To critically review the literature and other secondary sources relating to;
 - environmentally responsible design approaches (methods, tools, processes; information), environmental business issues;
 - relevant legislation and policy, voluntary initiatives and market information;
 - issues of technological development;
 - sustainable development.
- To produce an overview of designer attitudes and actions to integrating environmental criteria within design and development by means of telephone and postal surveys of UK designers.
- To use the literature review and the findings of the exploratory surveys to formulate further questions and direction for the main research study.
- To establish a suitable focus group of designers for the main, in-depth study.
- To explore the concepts of 'ecodesign' and designers' understanding of the issues.
- To explore issues surrounding the development of more environmentally benign designs.
- To gain an understanding of the opportunities and restrictions, from a design perspective, associated with integrating environmental criteria within design processes.
- To develop an understanding of the position of ecodesign within current UK design industry and directions for future development in this area.

1.5 Outline of the thesis

The thesis consists of a further seven chapters. A brief overview of each of these chapters is provided below.

Chapter Two

The literature review. This focuses on the development of concepts of ecodesign within the context of the twentieth century and addresses the growing pressures on industry to integrate environmental responsibility within business practice. The chapter concludes by summarising the main findings applicable to introducing ecodesign concepts into design practice.

Chapter Three

Presents an overview of the methodology; it explains and justifies the various methodological approaches chosen for the research.

Chapter Four

Reports on the findings of the pilot surveys of UK design consultancies and three sectors of manufacturing industry and summarises the main implications for the in-depth research study.

Chapter Five

A methodological review chapter. As a result of the exploratory research findings described in chapter four, this chapter presents an overview of all research findings to date and uses these findings to justify a change in the research emphasis for the main study.

Chapter Six

Reports the findings from the in-depth interviews with design personnel in UK design-based companies and design consultancies.

Chapter Seven

Provides a discussion of the findings from the pilot surveys and the main research case studies.

Chapter Eight

Based on the research findings and discussion, this chapter concludes the research work by addressing future issues for sustainable design, sustainable development and the future direction of design.

A bibliography and appendices are presented at the end of the thesis.

ECODESIGN

Chapter 2

A Review of the Literature

'Design directly expresses the cultural, social, political and economic complexion of our society, and it thus provides a snapshot of that society's condition. In so doing it reveals a great deal about a society's priorities and values. Design matters: it is too important just to celebrate, collect or historicize. The world situation demands that we develop a greater awareness of design's explicit and implicit values and their implications, and exercise a greater control of design in our societies.'

(Nigel Whiteley, 1995)

2.1 Introduction

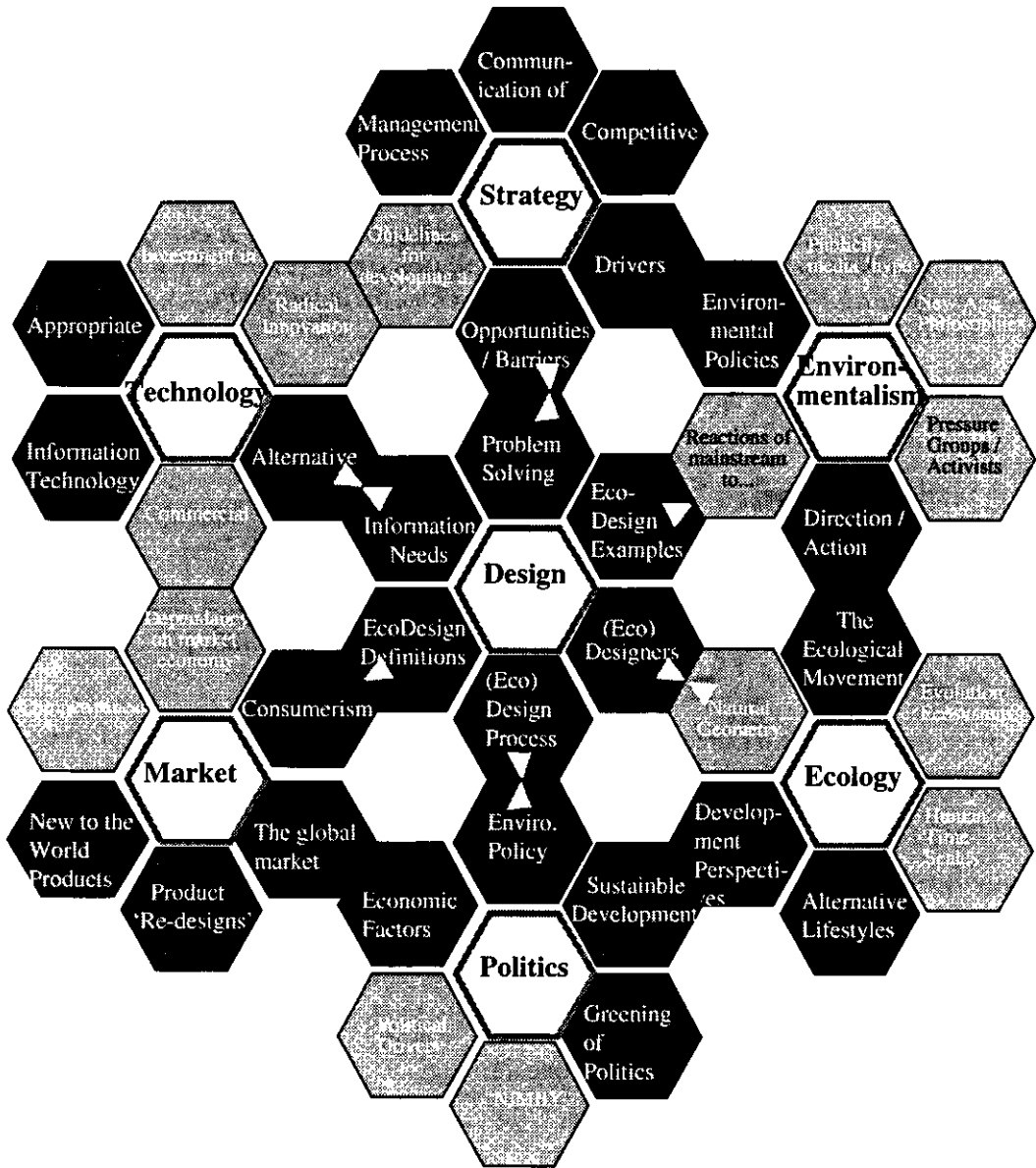
The aim of this chapter is to present an overview of the ecodesign literature and place it in context within a variety of other subject areas namely environmental, political and management texts.

Due to the multifarious nature of design and subsequently ecodesign, much of the literature extends into quite diverse fields. However, in order to position ecodesign firmly in the design literature, it is necessary to support the 'diversity' of information by relying on quite disparate sources. From this it is hoped that the reader may form a clearer picture of:

- how ecodesign has developed historically within the subject area of design,
- how ecodesign is quantified,
- what the current priorities for ecodesign are,
- how further developments in this field can be supported.

Figure 2.1 illustrates the prevalent subject areas that have had some impact on the ecodesign literature. All of this literature is relevant, but because of its diversity, almost impossible to investigate in a thorough manner for this thesis. Hence the focus for this literature review has been primarily on the central core of design with other subject areas feeding in where appropriate.

This will present a sufficiently broad picture for ecodesign to be defined and contextualised within other subject areas. The literature review should also firmly establish the research questions to be addressed by this research project.



The 'honeycomb' illustrates the broad scope of connected literature. The more shaded elements show the main focus of this ecodesign literature review.

Figure 2.1

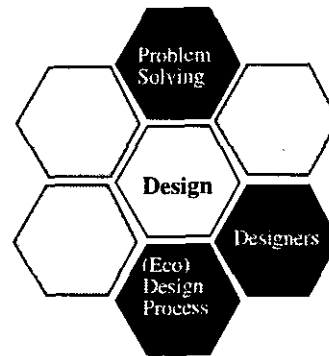
2.2 Structure of the chapter

Throughout the chapter there is a continued focus on (eco)design. Other areas such as ecology, the environmental movement, technological innovation, management, market and politics are pursued at various stages to support the core design literature as illustrated in Figure 2.1.

The chapter has been divided into four parts:-

1. Describes design and the design process.
2. Presents an historical overview of ecodesign over the twentieth century.
3. Addresses current ecodesign literature and places a particular emphasis on the design process, information, design examples, and strategic and political action.
4. Summarises the main points raised by the literature review and other secondary research sources.

2.3 An introduction to design



2.3.1 What is design?

Design: *a preliminary plan or sketch for the making or production of a building, machine, garment, etc.; the art of producing these; the general arrangement or layout of a product.*

(The concise Oxford dictionary)

'Design establishes and defines solutions to, and pertinent structures for, problems not solved before, or new solutions to problems which have previously been solved in different ways'
(Blummich 1970)

This basic premise has been the building block for design thinking over many centuries although priorities acting on this 'design' process ultimately change as time goes by, and technology and society progress and become more 'sophisticated' in their needs and their wants. However, it is since the integration of the industrial machine into our everyday

existence that design as a subject area, has really matured and found its place between engineering and art.

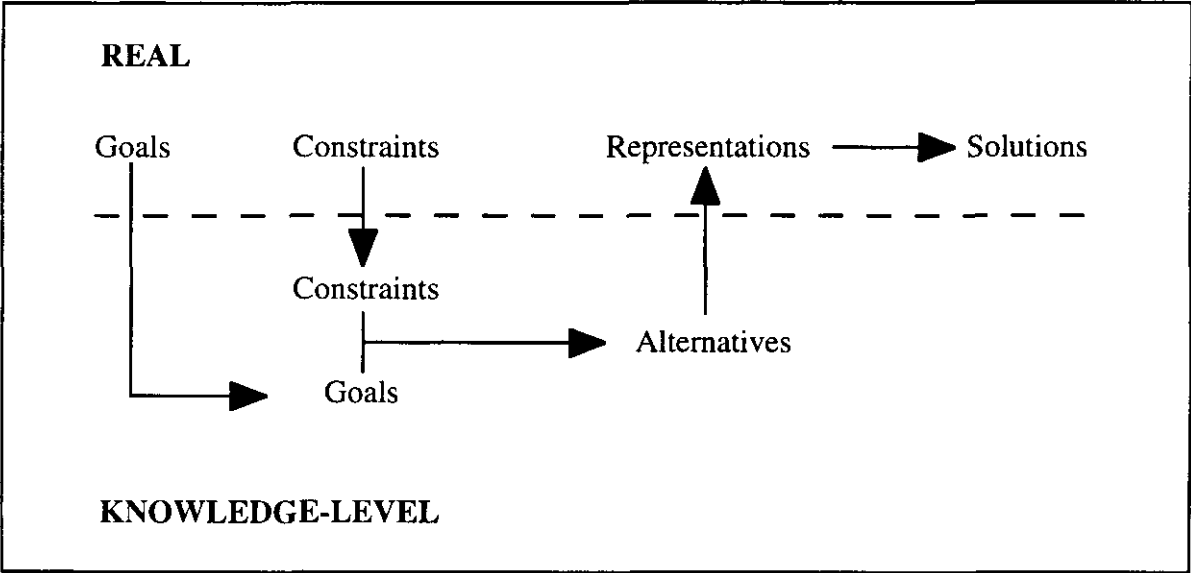
During the last 200 years the act of ‘designing’ has altered to satisfy more diverse problems. For instance design as a term may no longer be applied to solely ‘designing’ an artefact, a three or two-dimensional form, it is also associated with many human-related problems such as management and communication.

‘Design can mean the solving of a more complex system that encompass challenging design problems, that historically have not been recognised as design fields.’

Smith & Browne (1993)

2.3.2 Design problem solving

There are many feasible solutions to a design problem and it is the role of the designer to work through the design problem presented in the design brief, to find the optimum solution to that problem. A typical design problem encompasses five conceptual elements: goals, constraints, alternatives, representations and solutions as expressed in Figure 2.2



From: Smith & Browne (1993)

Figure 2.2

The concept of ‘a problem’ defines a situation or element that is undesirable and which may be solved in a variety of ways. Goals are a major element in problem solving. They vary in origin from the fundamental needs of existence to the more functional and aesthetic desires and wants manifested through human experience. Solutions are the inevitable result of the problem solving design process and are usually represented by a graphical or three dimensional image which aids the development of the final construction or manufacture of the design. Constraints are often present and are important in design as they help define the space of feasible alternatives which are the mentally envisaged possibilities that problem solvers identify and evaluate. They give the designer a parameter to work within to solve the design problem and thus connect the human imagination to the reality of the problem being solved. As Smith and Browne (1993) note:

'Constraints are the rules, requirements, relations. conventions and principles that define the context of designing'

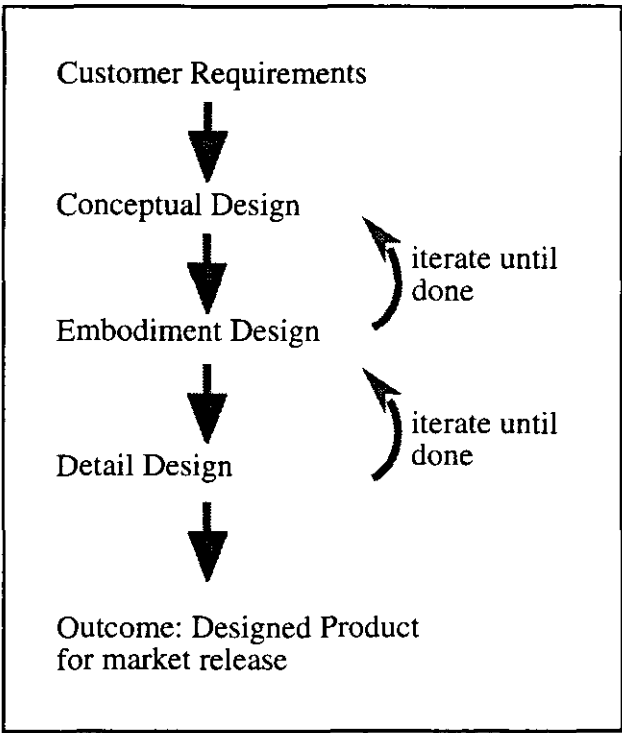
Fig 2.2 shows that there are both real and knowledge based elements in design problem solving. The former relates to the design criteria laid down in the defining the problem. It relates to the constraints imposed on the problem which denote characteristics of reality. Some of this knowledge and experience will be included in the designer's knowledge. Both goals and constraints must be mentally recognised by the designer in order that acceptable alternatives can be generated. The last step of converting acceptable alternatives into a design solution is the process of reconnecting design with the real world.

2.3.3 The design process

The design brief is therefore governed by external constraints and the implicit guidelines imposed by the client which represent the goals the design solution should satisfy.

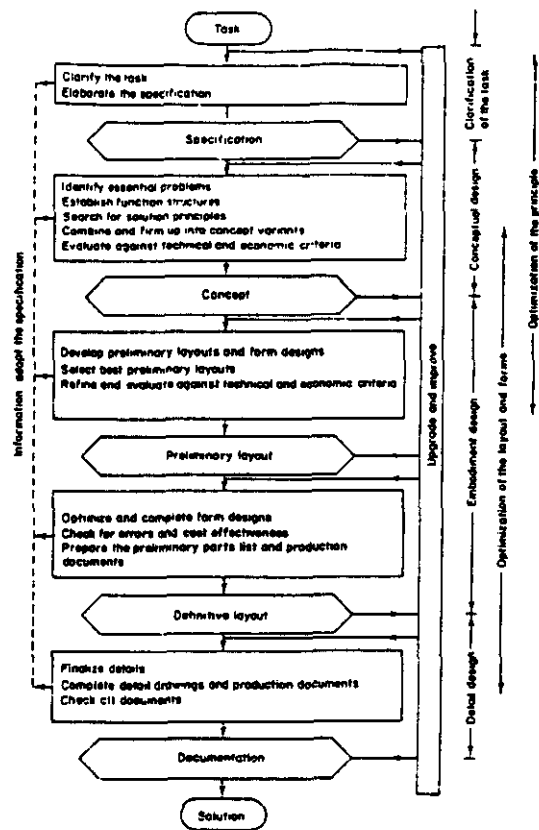
(Jones 1984)

The design process model is shown in Figure 2.3 and Figure 2.4, and effectively illustrates the components of the design process where feedback loops are incorporated and act as safety nets in order that the designer may test and analyse the design solution(s) throughout the design process. This model has been adapted for the British Standard on Design Management and is widely acknowledged as a good representation of the design process. There are however, other design process models, many of these follow a similar theme to the Pahl & Beitz model, [Archer (1969), Svensson (1975), Cross et. al. (1994), Jones (1992)].



Design Sequence as described in BS 7000, after Pahl & Beitz (1984)

Figure 2.3



A comprehensive overview of the Pahl & Beitz model as presented in Cross et. al. (1994)

Figure 2.4

The stages illustrated in this model are as follows:

A clarification of the task

Here information is collected regarding the requirements to be integrated into the design solution and the constraints placed upon the design brief.

Conceptual Design

The designer should identify the main problems and established what the design must achieve. Should investigate a number of solution scenarios and evaluate these against original constraints set by design brief.

Embodiment Design

Using concept designs the designer should determine the layout and form of the design and continue to evaluate the design(s) against the original / new design criteria. Aim is to optimise the design and develop a technical product or system in accordance with technical and economic considerations.

Detailed Design

A definite layout of the design should be produced encompassing the arrangement, form, dimensions and surface properties. Material specifications and technical and economic feasibility should be re-checked and production documents drawn up.

This is a systematic overview of the design process. Throughout this process it is imperative that the designer continues to re-evaluate the initial design specifications and include any new additions to this list as the process develops. Unfortunately, in practice, this process may not be so organised and problems do occur, particularly with regard to actually defining the design need, i.e., formalising the design brief. Thus, for example, Constable (1994) observes:

'While many managers are prolific writers of memos on other subjects, they find it strangely difficult to commit design briefs to paper. In such circumstances the staff designer should volunteer a brief as the first move to getting an agreed, thorough and written statement of what is needed. For design work to be undertaken in the absence of an agreed brief - as is frequently the case - is a gross lapse in sound management practice.'

Today goals and constraints tend to be governed by a shortening of 'time to manufacture' and attempts to boost flagging profit margins. There is currently a lack of focus for the development of design solutions to many of the real problems impacting on society and the environment; problems such as the overproduction of products to satisfy the increasing demand of a global market, a mounting waste problem, natural resource depletion, poorer air quality. In general these very real factors are being ignored by those involved in either specifying or completing design problem solving (Papanek, 1995). It is also because of this oversight that many of the designs on today's market, around 90%, are merely redesigns or modifications to existing products or extensions of product ranges. Innovative new design accounts for only 3-4% of new products (Hanmer-Lloyd 1977)

Many companies also find themselves managing design incorrectly which results in products that are late to the market with time-scales and costs that are overrun. (Constable 1994). Many of these problems could be avoided or at least lessened with a greater degree of consideration of design and design requirements at management level. In addition to this a revised direction for product development goals within companies might be beneficial to long-term productivity.

Overall, although the design process is comprehensive in theory, in practice it becomes channelled to a concentration on redesigns and modifications of existing products. This current emphasis on design relates to short-term product launches and dispensable products. A more environmentally responsible design ethic endorses projects that have an empathy towards promoting the future longevity of a global society and environment (Papanek 1995)

This suggests that environmentally responsible design is an opportunity to rediscover design; it highlights issues that are currently outside the remit of the design process and promotes the need for a 'rethinking' of the need, purpose, and capability of design.

(Whiteley 1995). These represent various 'times' in the design profession; times where the profession has been primarily concerned with commercially oriented design and market-led forces and, conversely, other times where it has promoted the devastation that a blinkered vision of commerciality can bring when represented through the 'designed' artefact. The book, *Design for Business* written by J Lippincott, an American industrial designer, describes the rampant consumerist American design ethic devoted entirely to glamorous styling and built-in obsolescence in product development. As the author of *'Design for Society'* puts it,

it is an eulogy for consumerist values - it promotes and upholds the values that Design for Society attempts to question'

(Whiteley, 1995)

These values were also questioned by the designer and architect, Victor Papanek in his "anti-design-establishment" book, *Design for the Real World*, originally published in the early 1970's. Similar doubts about the 'sustainability' of a consumerist system were raised in this book, although Papanek concentrated on design solutions to 'low-tech' problems of developing nations. He made little progress in proposing solutions for 'western' societies addiction to material artefacts. Within ten years of his book being published the era of 'Thatcherism' had established itself in the UK and the Government enthusiastically welcomed design as a solution to the economic ills of the time and manufacturers were encouraged to use design as a tool for enhancing competitiveness and improving profit margins (Design Council, 1986; DTI, 1991). The 1980's subsequently became known as the designer decade with the term 'designer' prefixing every imaginable saleable commodity from fashion to cars, from food to interiors. Whiteley clearly expresses the disillusionment with design at this time in his recent book, *'Design for Society'*. He attempts to address current concerns regarding the future of the design profession in a society that presently ignores important issues such as sustainability, population growth and global development - he aims to highlight the links between a more sustainable design ethic and the future existence of humankind. In summary he considers that we have now reached a point in time where it is appropriate that designers reconsider their role in society and this is echoed by some of the designers he mentions in the book in discussing design behaviour in the Thatcher era:

'Like the US and Japan (Britain) enthusiastically pursued an uncritical free market system and abandoned it's broader responsibilities. When designers do likewise, operating solely as a tool for consumerism, their status becomes questionable. The current recession has given architects and designers an opportunity to reconsider their role.'

David Chipperfield, David Chipperfield Architects. (quoted in Whiteley 1995)

Myerson's four phrases to describe design succeed in portraying a profession based on changing drivers and priorities and it is from this standpoint that the future of the design industry must be questioned in the context of a more sustainable system. In order to

comprehend exactly what this ‘sustainable system’ might involve, it is imperative to consider the development of society and design’s role in that society over the past century.. By placing design in this rapidly developing industrial society a clearer picture is gained of where we are today and how we arrived. The rapid industrial development of the nineteenth and twentieth centuries has achieved a sophisticated and high standard of living for a part of the world’s population - a greater proportion of the global population still exist in relative poverty with basic technological input into their everyday lives. The result of this development has also produced a proliferation of environmental and social problems. It is necessary to understand the priorities underlying this development process in order that these priorities may be redefined and design may emerge with a different set of criteria to tackle societal and environmental problems in the new millennium.

2.4.2 The historical perspective

Industrialisation has progressed dramatically over the past 200 years. From the origins of machines to benefit rural labour, to the use of machines to enhance factory production and from the development of new technologies to fight world wars, to developing industries that rely on mass produced products. And now, in a trans-industrial age (Kinsman 1990), industrial societies are developing further towards a post-industrial age- an Information Age. This dramatic rise of the machine and technology in our society has had large and unforeseeable consequences for humankind globally. The urbanisation of our lands, the dependency on food produced globally, not locally, the rise in expectations of populations generally - in terms of health, wealth, security and needs and wants. Set against this backdrop there is the development of ‘design’ as a profession.

Table 2.1 illustrates the development of design with regard to technological, market, environmental and political factors within each decade of the twentieth century. It was developed by the author of this thesis to present a concise overview of a century’s design history set within the ‘wider picture’ of industrialisation and is helpful in providing guidance for the reader in this next section. Table 2.1 does not attempt to cover twentieth century development in detail but it does aim to indicate the trends and developments that have been so important in moving design forward to its current position. By placing design in this context the concept of ‘designing’, as is currently practised, can be understood and proposals for a refocusing of design priorities can be viewed in relation to past design development.

1900s	1910s	1920s	1930s	1940s
Environmental Factors				
Ecological issues were generally associated with health, sanitation and living environments. An interest in ruralism, organic farming, naturalism by an elite minority. Continuation of the move of populations away from rural communities to town developments. Agricultural practices encourage increasing misuse of land, quantity undermining quality. (Bramwell 1989).	Health, sanitation and living environments are still very much a society focus. Great human loss due to World War I. Towards end of this decade is an increase in living standards and greater amounts of information freely available on health and diet. War effort also demonstrated a new role for women in society	Development of: Rural Traditionalism - 'The Britons', Experimental Holism - Naturism, Vegetarianism, Corporate Conservation - Forestry Commission, Rural Community Councils, National Trust, RSPB. Rapid urban development leads way to 'countryside appreciation'. 'Environment' begins to be viewed as an entity in itself rather than solely related to the human condition. (Coates 1993)	Development of popular clubs; The Camping Club, Youth Hostel Association, and the extension of the Ramblers Association. This was seen as a movement towards the left and towards Popular Appreciation, 'Grass Roots' clubs. Tended to be supported more by the middle classes. (Coates 1993) Oil ousted coal's position as a source of fuel - the industrial & social implications of this were to have a dramatic impact on development to date.	Damage to nation through war time - both to humans & to the physical environment. Post war reassessment of nations' values. Attlee's post war administration bring in Town and Planning statutes. (Robinson 1992). Rapid industrial development, new material development, the age of 'rapid consumption' was about to dawn.
Design Factors				
William Morris in particular, as a key figure in the British Arts and Crafts movement of the latter years of last century publicly rejected the seemingly destructive pattern of industrialisation sweeping the Western world. His concerns were of the repopulating of communities around industrial centres, of the rejection of ruralism and small communities and their power and responsibility. Morris, however, did not reject the machine altogether. The Kelmscott Press was his printing works that enthusiastically endorsed new technology. Morris worshipped the organic in design and was one of few designers to support his political ideals through the design ethics he worked to (McCarthy 1979)	Inspired by the Werkbund exhibition in Cologne, 1912 (eg. the 'modern factory' by Gropius), British designers (Harold Stabler et al.) set up the Design and Industries Association - DIA in 1914. Stabler and other rebels of Arts and Crafts saw in Germany 'an absolute acceptance of mechanisation with its mass-production disciplines and anonymity'; in essence the visions they perceived were to be the future in British design. The DIA expanded rapidly, many of its members drawn from Arts and Crafts societies. (1919 - Gropius founded the Bauhaus.) (McCarthy 1979) The Bauhaus vision was one where the modernist would invent the type-form - the optimum solution to a functional problem for every product	First synthetic plastic - Bakelite. Used in many objects of the time, eg. radios & telephones. Important developments for materials through the synthesis of rubber - the idea of long, complex chains is born. (Katz 1984) The British Institute of Industrial Art, concept originated 1914 but delayed due to war, opened in 1920 with financial backing from the Board of Trade and Board of Education. Good co-operation with the DIA through the 20's until grant was withdrawn. Among the aims of DIA was the design of products that were 'simple, soundly designed and well made of excellent materials', 'properly planned and thoroughly useful' (McCarthy 1979)	As a result of a Board of Trade Committee on Art and Education the 1932 report concluded 'that in order to raise national design standards the citizen must be made design conscious' - Exhibitions were nation-wide. This message was also a central theme in Antony Bertram's 1938 'Design'. Many designers (Heal, Wells Coates, Pritchard) complained exhibitions showed frivolity and far too many fashionable 'amusing' ideas'. Hectic decade for plastics discovery; injection moulding became more complex and greatly reduced prices because of this. Cheap and nasty image of plastics occurred due to poor mouldings and scrimped designs. (McCarthy 1979, Katz 1984)	1944 saw the appointment of The Council of Industrial Design, CoID - 'to promote by all practical means the improvement of design in the products of British industry.' Sir Stafford Cripps, President of the Board of Trade talked about producing 'goods as suitable for peace time as were the weapons the country produced for the war 'Britain Can Make It' exhibition, 1946 - a review of design post-war ... Misha Black told the public 'what industrial Design means' in 'The Birth of an Eggcup'. Utility design (eg furniture) - good design, best possible materials, produced quickly: this thinking led design into the 50's. A greater awareness of design within the home environment. (Spark 1986, McCarthy 1979)
Political , Technological & Market Factors				
Acts from last century attempted to deal with the fundamental problems of health and sanitation. From the report of the 1934 Poor Law Commission which dealt with the basic environmental concerns of an expanding urban working population sprang the Toren's Artisans' and Labourers Dwelling Act 1868 and a subsequent improvement Act of 1875. Environment taken on board in a political context - 'quality of the physical environment directly affected the quality of the human condition' (Robinson 1992)	World War I. Emphasis on Nationalism (Bramwell 1989) War effort unites a mainly female workforce - the suffragette movement gains increasing support from last decade. Advances in technology due to war and experimentation with new materials - plastics. Greater imports of German & Austrian goods which were better quality than British goods. Government began to recognise the importance of 'good' design in mass production. (McCarthy 1979) mass production developments, based around cheapness and availability, in the USA re. Henry Ford's car industry	Prime Minister, Ramsey McDonald named mass unemployment as his Government's principle target. Also introduced an ambitious slum clearance and house building programme. Miners strike in protest of increasing cuts. Women over 21 win equal suffrage in elections. (Chronicle, Longman) Styling becomes an issue in selling products- it was seen as an opportunity to boost minority markets. The consumer had a greater degree of choice - "any colour so long as it's black"!	Under Baldwin's Government Britain adds to armed forces - in response to Germany's return to conscription. Large unemployment. World War 2 declared - Chamberlain leads Britain to war in response to Germany's invasion of Poland. The demand for consumer products was still quite small and it wasn't until after the war that the dawn of the consumer market really came of age.	World War 2, 1940. Male population goes to war, women are the main workforce. Industries set up to support war effort, technology advances considerably in the search for better methods or strategic advantage - radar, transport, weapons - new technology for victory. (Chronicle, Longman). Welfare state, health service set up by Attlee's Government. The technological developments made in during wartime to facilitate efficient, innovative cost reduction production for weapons, was used to establish a new consumption pattern - the consumer years

1950s	1960s	1970s	1980s	1990s
Environmental Factors				
Larger number of individuals supporting grass roots organisations. Patterns of consumption continue rise as does GNP. Concern is voiced over the quality of air - the fear of pollution gains momentum and public concern forces a debate on air quality 1956 Clean air Act, UK. Growing trends towards car ownership - equalling prosperity do little to minimise problems associated with air quality!	The birth of 'deep' ecology - an increasing appreciation of the issues across a broad range of society. Ecology seen as a radical alternative movement of 'the left', taken on board by the 'youth movement' as an issue amongst many others. <i>Rachel Carson's 'Silent Spring'</i> published 1962 - First book to address environmental issues as a whole to a wide audience.	The late 60's and early 70's are widely cited as the years of peak public interest in the environment (evidence suggests that media coverage of environmental issues reached a peak between 1972 & 1973) (<i>Robinson 1992</i>) Major issue of this time was the 1973 OPEC oil crisis. A focusing on fossil fuels supplies & pollutants. Alternative technologies developed and are greatly publicised. James Lovelock develops Gaia Hypothesis (<i>Lovelock 1979</i>) A number of 'end of pipe' solutions applied in industry.	A lapse in overall environmental concern. Hedonism rules, consuming becomes an entity unto itself. (<i>Jollant-Kneehone 1992</i>) Environmental NGO's had a dramatic increase in membership - a seemingly reaffirmation of views held by many in the 70's; action shown through the purchasing of 'greener' products, support more from the wealthier 'middle class' than from the youth movement mid - late 80's saw the birth of the 'Green consumer'. Research indicates irrefutable damage to environment.	Late eighties boom on environmental focus somewhat merges into the background due to the recession. Scientific research continues to support and add to claims of major environmental degradation. The waste industry rapidly expands - recycling issues reach to a wider public because of media (& retailer) publicity. Multi-nationals especially, continue to advertise their 'green' behaviour. Environmental management seems to be increasingly important amongst companies 'credentials' - the British Standard, BS7750 increasingly sought after.
Design Factors				
The 'birth' of the consumer age - glamour & luxury living. The decade that will be remembered most for the conception of the 'annual' automobile in the USA; built in obsolescence, styling, disposability. Women were more discerning, they had a greater idea of what they wanted in their homes, a greater exposure to 'designed' products and generally a more vocal role to play in choosing items for the home. (<i>Spark, 1986</i>) Housewives held parties based around purchasing for example, the Tupperware Party. (<i>Katz 1984</i>) Festival of Britain took place 1951 to commemorate the Great Exhibition, 1851. Haymarket Design Centre opened 1956 & the Design Centre Awards began in 1957.	The 'ultra-modern', 'newlook' age. Boom years of consumerism hyped by media, illustrated trends of a new iconoclastic lifestyle. All areas of design seem to become slaves to a 'fashion' (<i>Katz 1984</i>) Alternative or Radical Technology movement began to develop as part of the counter-culture movement of the 60's. AT very much associated with the writings of economist / philosopher, E.F. Schumacher. Concept, 'Design for Need' came into being taken on board by a few designers, the most notorious of these being Victor Papanek and Gui Bonsiepe. (<i>Madge 1993</i>) Discussion of development issues and appropriate design gradually happening, late 60's.	Oil crisis has a knock-on effect and there is a shortage of petroleum based material - heavy competition for resources. Emphasis fell on exploring existing materials - invention of super-polymers. (<i>Katz 1984</i>) Microchip technology led to numerous applications for design and a barrage of new products appeared on the market .. the high-tech, IT era had begun. Papanek's book 'Design for the Real world' was published and received much publicity - illustrated parallels in design for need, development issues and alternative technology. This theme was taken on board by ICSID* at many of their international conferences during the decade. (<i>Madge 1993</i>) * International Council of Society of Industrial Designers	The 'age of the designer'! Style / gadgets equated power with status. Micro-electronics rapidly developed and led to 'miniaturisation', a feature of design. Also enabled new horizons to be found in the transferring of information - the era of information technology and mass communication. Many new products as a result of this. The idea of ownership, one on one was portrayed through the design of products such as the Sony Walkman - a success story of these years. Green Design Exhibition supported by the Design Council - 1986. Some manufacturers taking on broad green issues- though often merely as a marketing ploy. Design for disassembly / recycling publicised by large companies, IBM, BMW, Ford.	Green Design books published <i>Burall</i> and <i>MacKenzie</i> . Packaging industry faces high media attention resulting in greater awareness of issues among packaging designers - especially from the client's brief (own research 1993) Chartered Society of Designers CSD starts a 'green design' group. The Ecological Design Association EDA, started in the late eighties, sees a dramatic rise in membership. Ecodesign begins to be discussed more in popular design press. RSA, DTI, DOE support initiatives on Ecodesign. Examples of ecodesign publicised from research initiatives worldwide; Eureka Euro. programme. RMIT, TNO....
Political, Technological & Market Factors				
Churchill back in power. Growth economy, unemployment down, GNP increasing. The Utility days were fading into memory and the development of the concept of a market economy was born. Marketers persuaded people to purchase new items, previously seen as excessive. Consumer credit came into existence and purchases were now made based on future income. 'Styling' became a status symbol originating from USA auto. design. Obsolescence became seen as integral part of design thinking.	Resource led 'Limits to Growth' report raises concerns over fuel. Between 1966 & 1975 showed the greatest expansion in the number of national environmental groups. (<i>Robinson 1992</i>) New materials and technologies introduced capabilities for increased levels of spending with a new emphasis on 'fun'. The materialistic based life-style was a central part of 'western' existence.	The creation of the Department of the Environment DOE in 1970 symbolised the advent of new political awareness which recognised the socio-economic concerns. Green political thought progressed and was integrated into the UK political system. (<i>Dobson 1990</i>) Club of Rome report 1972 - action needs to be taken now! Energy legislation (States) focused on the White Goods Industry. There was a general questioning of the reliance on a technological economy with a shift (in ideals, not necessarily practice) to a more alternative technological approach	The Thatcher years. Support for entrepreneurship - small/medium firms, support for innovation from the individual. Government supports a funded Design Consultancy scheme within industry. Green Party increases support and takes 15% of the UK votes in the 1989 European Elections. Increasing amounts of environmental legislation (especially from Europe - Germany). Saw the dawning of the new information age and the prolific development of new types of product. Ownership, once more, became a status symbol. Green consumerism emerged as an opportunity, in some cases, for 'inventive marketing'!	The economy, not the environment is the main focus of the British Government. CBI - The Environment Council set up to help industry make correct environmental decisions. A political focus on the development of the European Union - environmental legislation filtering to British industry across all sectors of manufacturing. Global Environmental Summit, Rio. 1992 white paper, 'Our Common Inheritance'. FOE and New Consumer highlighted green marketing 'cons' and unethical companies thus dampening the enthusiasm for 'green marketing' in some quarters. Increasing scientific evidence points towards a relationship between the direct human impact on the global environment

2.4.3 The new industrialisation

By the turn of this century designers such as William Morris, John Ruskin, Ford Madox Brown, Richard Norman Shaw, Philip Webb, and Arthur Mackmurdo, (all influential members of the Arts and Crafts movement), had stood up against the increasing 'industrialisation' of their time. In Mackmurdo's own words:

'I burned with an overmastering discontent with the way things were.'

(quoted in Lutchmansingh 1990)

With regard to art and design, Mackmurdo criticised concepts of popularised evolutionism such as the "law of nature", the "organism" of society and "organic evolution", the "fierce struggle" of competitive commerce and the need for "social synthesis". He saw the future in the two disparate principles of traditional craftsmanship, perceived to be increasingly threatened by industrial manufacture and the operations of the free market, and the urgent need for a new, scientific basis of historical understanding and social reconstruction. What has remained distinctive about his role as an early modernist has been Mackmurdo's conviction that science could play a part in the formation of a style that was serviceable to modern needs. (Lutchmansingh 1990)

William Morris spoke of his concerns regarding the repopulating of communities around industrial centres, of the rejection of ruralism and small communities with their own 'power' and responsibility and of the effects of a mass producing society. He was probably the first designer to realise that his 'political' or 'social' vision was interlinked with his work as a designer. MacCarthy (1979) notes:

'Morris's titanic energy was tempered by considerable realism. He could compromise... He was not a lone reformer, shouting out against the world; he was in the thick of it, and his influence was large'

Morris did not reject technology; he did in fact design a printing press that utilised new technology, but his concerns were over what he perceived to be the inevitable path of industrialisation. He was one of the first designers to express what we would now today class as a 'deep ecological' opinion (Madge 1993).

2.4.4 Fordism and mass production

In the early 1900's the first design movements were established in Germany. First came the Werkbund and from this developed the Bauhaus; the first design ideologies was established. The idea of these modernists was that 'the notion of choice and variety in the design and styling of products was unnecessary, outdated and socially divisive. Modernists would invent the type-form; the perfect or at least the optimum solution to a functional problem for every product. [Whiteley (1995), Jollant-Kneebone (1992)]. Their view was one of technological progressivism where it was the responsibility of the designer to maximise the new technologies for the benefit of the general public. However, in practice,

the products and buildings that were designed and built tended to cater more for tastes of a cultured, open-minded elite than that of a large public (Jollant Kneebone 1992). Modernist design was about how architects and designers felt people should live; it did not grow out of the way people do live.

At around the same time an alternative approach to design was being developed in the USA by Henry Ford. It too revolved around technological development but in a way that allowed the product to be built for the potentially large market - mass production was born and was based on cheapness and availability. This manifested itself in the first Ford motor car, the Model T, and gave the opportunity to an eager American public to own their own transport. There was one basic model that could be altered if the customer wanted 'an original' car - it was from this initial introduction to mass production that the phrase 'any colour so long as it's black' was born. Styling became more important as the decade progressed and was seen as an opportunity to boost the demand for a previously minority market. (Sheldon & Arens 1932). The inter-war years saw the development of ideals for a market economy and this it is from this basis that our current design ethic arose - "obsolescence equated with 'progressive' waste or 'creative' waste." (Whiteley 1995) Even so, in the 1920's and 1930's, the demand for 'consumer' products was still quite small. It took the sweeping technological developments made in the second world war to establish the technology needed for efficient, innovative, cost reductive production. The ability to produce goods in this way led to striking differences in post-war consumption compared to that of the inter-war years.

2.4.5 Post-war prosperity

The priority after the Second World war was to produce quantity; aspects such as quality and design were subsumed. The aim was to ensure the sufficient production of basic goods. Jollant-Kneebone (1992) observes:

'England, a technical victor, faltered and fell in the world of design. It's system of rationing, the Utility scheme, extended aspects of pre-war functionalism into the most common strata to create rational but uninspired designs.'

The British post-war design exhibition 'Britain Can Make It' of 1946 aimed to show the capabilities of British design and to raise the public's awareness of the design process. This was illustrated by a number of products. For example, Mischa Black's, 'The Birth of the Egg Cup', showed the different stages involved in the design process for an egg cup. Good design was seen as using the best possible materials and the quickest production processes; this thinking led design into the 1950's (Sparke 1986)

By the 1950's the consumer society had been established. The production and design capabilities were in place, but there was a lack of 'new' consumers. Before the Second

World war people owned necessities and very few 'luxury' items. In these post war years the inventiveness of marketers had to persuade people to purchase new items, previously thought to be excessive. Hence the concept of the modern day market economy was born. Women took on greater responsibilities during the war which resulted in a more discerning consumer base; they knew what they wanted for their homes and their families and it was up to the designers to produce these goods and for the advertisers to sell them. Consumer credit was also invented at this time and allowed purchases to be made on future income:

'...buying became a speculation of the future, money was no longer cash. One can say that the introduction of consumer credit was the birth certificate of the consumer society, and the very early signal of the post-industrial era.'

(Jollant-Kneebone 1992)

In the United States this design awareness was portrayed through the design of increasingly more luxurious cars. Styling features, originating from the car industry, migrated to domestic goods such as irons, kettles, toasters - there were an array of styled objects to choose from each having a certain 'status' attached to it.

Whiteley (1995) points out:

'One critic, noting how the high consumption/dynamic economy approach underlay auto-design, stated approvingly that the 1950's car had:

"taught it's owners to consume and it's makers to produce, for an economy in which the strictures of historical scarcity no longer apply. It had made waste through over consumption one of the indispensable gears of that economy, and has made it socially acceptable as well."

(page 15)

It was during this decade that planned obsolescence became seen as part of the American way of life. Whiteley goes on to say,

'The implications for design are profound. The consumer society was now being superseded by what I call the consumerist society. The former term is predicted on a market economy and so has been in existence for some centuries; consumerist society signifies an advanced state of consumer society and the market economy, in which private affluence on a mass scale is the dominant force in the marketplace.'

(page 16)

There were however at this time, a few American designers who did question the impact of their designs on the surrounding environment. The well-known architect Frank Lloyd Wright integrated a respect for the natural environment within his own designs. He felt it important to learn from other, more indigenous cultures, who lived alongside the land. He had a great respect for nature and this was reflected in all of his architecture. (Papanek 1993)

In the late 1950's and early 1960's some were already questioning the prolific rise in consumerism. Vance Packard wrote *The Hidden Persuaders*, *The Status Seekers* and *The Waste Makers* at this time. He questioned the growing 'consumer' oriented climate and in

particular the manipulative techniques used by advertisers to persuade the public of infinite 'needs' to enhance their lifestyles.

2.4.6 The 'first' ecological crisis

The development of an ecological movement stemmed from the 1960's and was spurred on by Rachel Carson's book, *Silent Spring*, generally recognised as the first publication to look at the effect of modern lifestyles on the environment as a whole.

In contrast to the 'birth' of the modern day ecological movement, the 1960's, in design terms, was a rather 'fun' decade for designers and the innovations in materials, especially plastics, allowed freedom in shape and form and, because of their low cost. This made design accessible to a large, receptive public.

By the 1970's a number of debates regarding present patterns of economic and industrial growth were emerging. People were questioning the type of economic growth that relied on technological innovations that perpetuated the throwaway ideal. The Club of Rome report of 1972 entitled *The Limits to Growth*, brought together environmentalists, economists, technologists and many others to present a case arguing for the limits to unconstrained global economic growth in the context of growing environmental concern. (Meadows et al 1972)

The oil crisis of 1973 had a dramatic effect on many industries, the plastic industry among these. Subsequently there was a material resource impact on design and the design profession was left to consider other material and energy resource solutions to design problems originally satisfied by the use of plastics and fossil fuels. Many industry sectors were hit hard, particularly in heavy industry on which the political and economic ideology of the post-war period was built.

'Caught unaware, designers didn't rethink their role, It should have been a time to stand away from mass production in order to look back to craftsmanship, to alternative methods of production. Yet, if this period is rich in written material about concern for the environment, ecology and the social role of the designer, it is always put in the perspective of the existing industrial mass production system. The designer of the 1970's was functionalist, a lackey of industry.'
(Jollant-Kneebone 1992)

As a result of the 1970s' energy crises there was a minority shift away from patterns of economic growth based on the current dominant technologies which were subject to manipulation by foreign cartels and market forces. This shift was represented in the 'alternative technology' movement which supported the growth of non conventional technologies and the use of renewable energy resources all of which favoured decentralised, competitive markets with personal initiative and small entrepreneurs where

the role of government could be reduced (Boyle et al 1977). The alternative technology movement was firmly focused within the context of developed countries.

British economist Fritz Schumacher in his book entitled *Economics as if People Mattered* (1973) argued that the sophisticated, highly capital technology of modern industry was

'inherently violent, ecologically damaging, self-defeating in terms of non-renewable resources and stultifying for the human person'
(page 163)

Schumacher's *Small is Beautiful* (1976) again questioned the reliance on a technological economy and the materialistic lifestyle it evoked that demanded new, bigger, faster product turnover:

'An economic system based on Buddhist principles would not be concerned with the maximisation of production but sufficiency for everyone's needs, with the maximum of well-being with the minimum of consumption' (page 48)

In comparison to alternative technology and in relation to Schumacher's work, the 'appropriate technology' movement focused originally on developing countries.

Appropriate or intermediate technologies were defined as those that are 1) cheap enough to be accessible to nearly everyone, 2) simple enough to easily maintained and repaired, 3) suitable for small-scale application, 4) compatible with man's needs for creativity, and 5) self-educative in environmental awareness (Pursell 1993)

Politics became an integral part of the environmental debate through a deepening ecological movement associated with a greening of politics (Dobson 1990) and the popularisation of an anti-establishment, alternative lifestyle approach.

Environmentally and socially responsible design at the time was addressed primarily through looking at opportunities for design in developing nations. At its core, Victor Papanek's book *Design for the Real World* (1971) questioned the immorality of consumerist industrial design and the seemingly flippant disregard of design responsibility portrayed by the profession at large. His book angered the design establishment in the 1970's and was strongly rebuked as 'anti-design'. However, its second edition, published in 1984, clearly excited a new generation of designers. It is now recognised as the primary text that initiated socially responsible design concepts. The first edition discussed the need for a new design ethic and in particular focused on design for 'the Third World'. Papanek argued for the design profession to spend one tenth of their time or one tenth of their income on more socially responsible projects, and emphasised the scope for learning from indigenous cultures. Papanek addresses the (design) problems facing western societies and gives illustrated examples of more 'socially responsible' design solutions. He says:

'In this age of mass production when everything must be planned and designed, design has become the most powerful tool with which man shapes his tools and environments (and by extension, society and himself). This demands high social and moral responsibility from the designer. It also demands greater understanding of the people by those who practice design and more insight into the design process by the public.'

Design must become an innovative, highly creative, cross-disciplinary tool responsive to the true needs of men (and women). It must be more research oriented. and we must stop defiling the earth itself with poorly designed objects and structures.'

In *Design for Human Scale* (1983), also by Papanek, the focus is more on the relationship between ecology and design and draws a great deal on the work of Schumacher and the appropriate technology movement. His most recent book, *The Green Imperative* (1995) describes the damaging results of modern industrial practices on the ecosystem and criticises the role that commercial design has played in this environmental degradation. Papanek provides many examples of more environmentally and ethically responsible design from around the world and focuses more than his previous books, on the spiritual dimension of design, the environment and ethics; he is forever optimistic of the capability of design to overcome some of these global environmental problems and in taking this perspective, comes across as quite naive in his total faith in the discipline of design to encourage alternative social perspectives; he does not provide a political dimension in this book and therefore offers no solutions as to how political perspectives can change globally and what the role of design will be in this change.

Another designer who was also concerned with the social and environmental impact of design in the 1960's and 1970's was German-born, Guy Bonsiepe. His concerns have been primarily for design and development and the social relevance and the socio-economic context of industrial design. Madge points out that Bonsiepe, now based in Latin America,

'put great emphasis on the political context of design in the periphery and argued that what was needed was not design for developing countries but design in and by developing countries. There were two designs he said, design in and for central countries and design in and for developing countries and it was not certain that the right kind of infrastructure yet existed for developing design in the latter.'

Bonsiepe has discussed ecological design in a totally global context. The emergence of a new environment ethic implies a new design ethic:

'The unquestionable merit of eco-design consists in having articulated concerns which put into question paradigms of design and industrial production and consumption that we took for granted.'
(pages 152-155)

2.4.7 The dawning of a trans-industrial age

The 1980's was the true beginning of the trans-industrial era (Kinsman 1990). Not only was there a change in politics, but in values and in ethics too. Jollant-Kneebone (1992) points out that,

'where the 1970's crisis of confidence brought a search for spiritual values, the search in the 1980's was for material values.'
(page 507)

Optimism for growth, industrial production and innovation were high on the political agenda. Prime Minister Thatcher saw design as a key resource for a lagging manufacturing base and initiated Government support to encourage the use of design as a tool to enhance competitiveness and profit margins. Changing production methods allowed for greater variety and turnover of product designs and changed patterns of purchasing - peoples' desires and dreams were aroused through the 'things' they could buy and many had some element of 'status' attached to the purchase. One of the early 'successes' for design was the development of the Sony Walkman. This set the stage for 1980's design where the consumer was encouraged to believe and desire products, particularly designer 'labelled' products; ownership became a status symbol.

2.4.8 Second wave environmentalism or 'step onto the green bandwagon'

By the mid-eighties there were indications from a minority group of designers (e.g. O2 - a European 'Green' Design group) that there should be a concern regarding the association of design with the growing proliferation of products, the perpetuation of the social status association with 'designer' product ownership and the overall environmental degradation due to current levels of production and consumption, ranging from litter to global warming.

The environmental agenda began to infiltrate mature, industrialised societies. For example, in the 1989 European elections, the Green Party achieved a record high of 15% of the total vote highlighting a variety of environmental aims and objectives for addressing increasing environmental impacts of society. Terms such as global warming - the 'greenhouse effect', ozone depletion and CFC-free were commonly used by the media, and subsequently the general public began to understand and associate with these terms, (a concept that was central to the green marketing of certain products in the late 1980's). Mainstream political parties were attempting to address environmental issues within their party manifestos; Prime Minister Margaret Thatcher had previously viewed environmentalists as the 'enemy within', gnawing away at the heart of British society. However, in the September of 1988 Thatcher made her 'conversion' speech to the Royal Society where she introduced her concerns regarding environmental impacts and highlighted the long-term need for planetary stewardship. She acknowledged that:

'we may unwittingly be performing an experiment on the planet, the outcome of which we cannot predict with certainty.'
(quoted in Dobson 1990)

Such reactions to the threat of global environmental impacts from the mainstream political parties and industry helped 'centralised' the environmental debate, it helped move the media attention away from a marginalised, deep green perspective to that of a light green

perspective and in so doing, help popularise 'the green debate.' New environmental policies were prepared, new corporate programmes were envisaged and a new demand for environmental quality in the marketplace was viewed as an opportunity for a new consumer group - the 'green' consumers. (Dermody 1995)

At this time the environmental debate was addressed within the context of a perceived stable social and industrial framework. Scientific evidence connected, amongst many, CFC use and ozone depletion; leaded petrol and car pollution. Information such as this added to the growing concern of man's influence over the long-term effects on the environment. It was thought that by applying a set of environmental 'rules' to the present system the environmental problems would be alleviated or at least minimised. Environmental legislation has been a key driver in influencing changes in manufacturing processes and product development; for example in some cases toxic materials have been eliminated from processes and products, issues regarding disposal and recycling have been addressed, future environmental goals have been established internationally within a variety of industry sectors. The results of this type of 'reactive' action are presented in the form of 'green' product labelling (green consumerism), company environmental reports, political party environmental agendas and global environmental guidelines. In 1992 the United Nations held the World Conference on Environment and Development in Rio de Janeiro. This event called for global action for global solutions to global environmental problems. The UK Government produced a White Paper 'Our Common Inheritance', for the Rio conference, which outlined their environmental strategy for the future. Many countries attended this event and a number of legislative and voluntary guidelines were drawn up as a result of the summit.

Green design initiatives at this time were generally related to 'green' consumerism. In 1986 the Design Council held an exhibition entitled 'The Green Designer', which aimed to educate the public and the design profession as to what constituted 'green' design. (Burall 1991)

There were a number of companies marketing products as 'green' at the time, some were legitimate claims, others were unfortunately 'green cons'. Publications such as the *Green Consumer Guide* (Elkington and Hailes, 1988) established which companies were being honest and which were trying to market non-green products as green. Friends of the Earth also awarded the *Green Con Awards* and in effect, produced damaging publicity for those companies involved.

Dobson (1990) points out that there is inherently nothing green about green consumerism. Although activities such as putting pressure on manufacturers to ban CFC's, avoiding the purchase of mahogany toilet seats to save the rainforest or supporting the reusable bottle scheme of the Body Shop ask the consumer to change aspects of their thinking and behaviour. These activities show that it is possible for individuals to do something but the

consumer strategy in itself is arguably counter-productive at a deeper level of Green analysis. As Dobson (1990) points out:

- It does not confront the central Green point that unlimited production - consumption is unsustainable
- It alienates many people who do not have the money to spend in the first place
- It relates to environmentalism as opposed to ecologism in it's aim to *reform* rather than fundamentally *restructure* patterns of consumption.

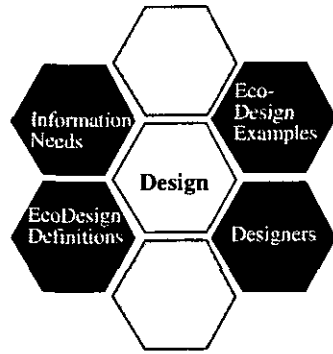
From a design perspective, Manzini (1994) refers to this (consumer strategy) period as a 'normalisation' of ecological design and gives examples of ecodesigns such as recycled car bumpers and non-CFC aerosols but stresses that these are not adequate responses by themselves. For sustainability to be a reality strategies are required that ask people to make radical changes to their existing lifestyles, and on a global level, require that the economic development model be thoroughly revised.

2.5 Summary

Part two of the literature review has presented an overview of the development of ecodesign values in the twentieth century. Throughout this time there have been few designers that have consciously looked at 'ecological' / societal issues and design - whether these have been architects like Frank Lloyd Wright whose buildings emphasise and reflect the environment in which they're built, or designers such as Papanek, Bonsiepe or Morris. All have contributed to the development of an ecological design philosophy. As presented in Table 2.1, the evolution of ecodesign thinking has been influenced by developments in the areas of politics, environment, technology and market. In the 1960's and 1970's the ecological design literature focused on attacking the development of the consumer economy and design's role in supporting this. The 'second' green design movement of the 1980's and 1990's accepted the current industrial development paradigm and worked within it to achieve environmental improvements of products through design. Much of this type of design has involved a 'tweaking' of existing products and has mostly focused on one or two environmental issues such as recycling and packaging. The marketing of these products and the growth in green consumerism has raised the awareness of the environmental impacts of some products. However it has also had a detrimental effect on the environmental cause through manufacturers' 'false' green claims which has led to doubts about any environmental claim made by manufacturers. This needs to be recognised if effective ecodesign strategies are to be developed for future societies where design is an interactive component of many other elements of societal and environmental development.

Part three of the literature review focuses on the more contemporary ecodesign literature; it addresses what constitutes environmentally responsible design today.

2.6 Ecodesign: the present day



' "When we look at a chair, we see the wood, but we fail to observe the tree, the forest, the carpenter, or our own mind. When we meditate on it, we can see the entire universe in all it's interwoven and interdependent relations in the chair. The presence of the wood reveals the presence of the tree. The presence of the leaf reveals the presence of the sun." Ecological design recognises that all problems - hence, all solutions - spring from this connectedness.'

Thich Nhat Hanh

(Quoted in *Ecological Design* by Sim Van der Ryn & Stuart Cowan, Island Press 1996, page 91)

2.6.1 Defining environmentally responsible design

'It is part of our function as designers to investigate and synthesise new technological possibilities which foster and promote a reduction of the environmental burden from our many activities and we should present these initiatives whenever possible and to whoever we can influence.'

(Sutcliffe, 1993)

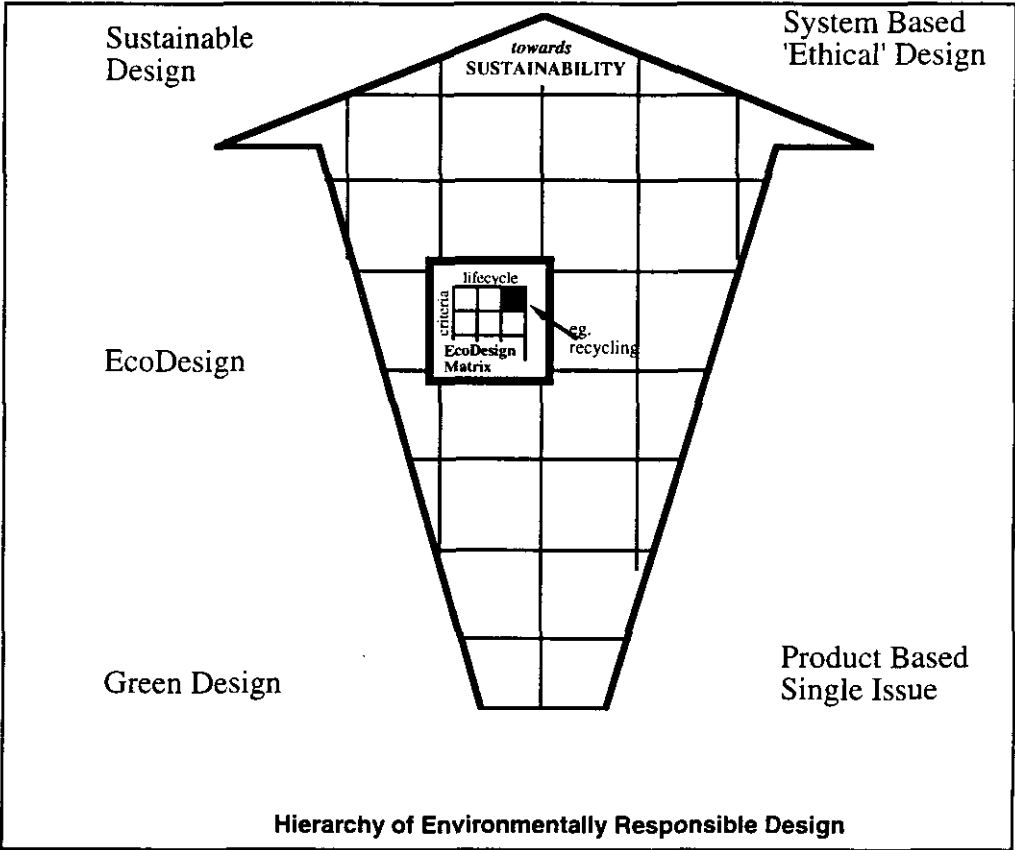
There are a number of terms used to describe 'environmentally responsible design'. Included in these are green design, design for environment, life-cycle design, eco-design and sustainable design - this is not an all inclusive list. Such terms relate to different levels of environmentally responsible design all of which address the main issue of reducing the environmental impact of a design in part or over its entire life cycle.

In this thesis, three terms will be used to describe the position on the hierarchy (Figure 2.5) of environmentally responsible designs. These are as follows:

GREEN DESIGN At a basic level, environmentally responsible design focuses on one or two particular areas of environmental impact such as energy efficiency or material recycling; this type of *green* design fits in with current design practices. Green design

tends to focus on the redesign of existing products. The assumption is that society has an existing demand and that a given product satisfies that demand - design at this level of environmental responsibility tends to be an 'improvement' activity where the product concept does not change.

Products that are (re)designed to protect people from increasing environmental damage, such as sun-block and portable UV meters, are referred to as 'environmentally ameliorative' products (Ryan 1992a). These are generally existing product concepts that have been altered or just marketed to satisfy a growing demand for protection against environmental damage.



(Dewberry and Goggin 1995)

Figure 2.5

ECODESIGN

Other types of environmentally responsible design that can be applied within existing design practices are termed *ecodesign* or *lifecycle design*; here the design process attempts to reduce and balance the environmental impacts of a product at each stage of its life cycle, from raw materials through to end of life disposal. At this level of environmentally responsible design the project addresses the current demands of the market but allows the designer to develop products that make sound environmental improvements. The key point is that the product must not go beyond the current market acceptance of 'newness' or be too 'radical' (e.g. the design of a car with catalyst and recycled bumpers as opposed to a solar powered vehicle). There are parallels here with the confines of the *ecodesign* approach which is moving more towards a systematic approach

but is still must work within the parameters of social and cultural expectations. (e.g. the design of a small 'city' car)

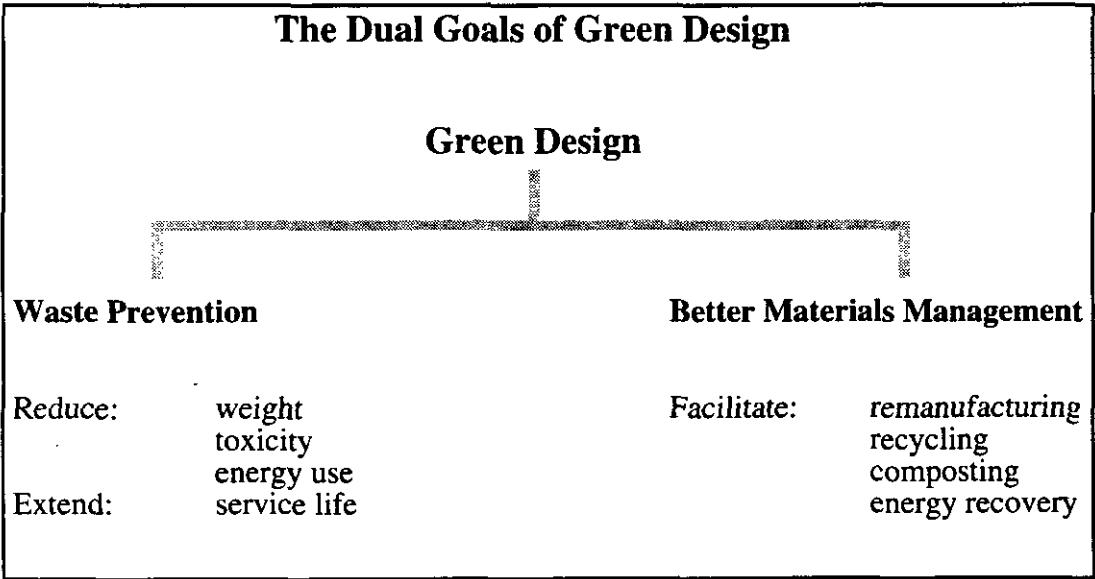
SUSTAINABLE DESIGN Beyond an ecodesign approach is a type of design that aims to satisfy design criteria within the complex system of sustainable development; this is referred to as *sustainable* design. At this level not only does the product change but also the demand - the main problem is a systems based one - can designers imagine a new demand? The designer has the capability to know what technically can be done by imagining something that does not exist until that moment. At this level the designers role is to propose some image of a different world. (e.g. design of a public transport system that can be summoned by telephone). Design moves beyond the present concepts of design responsibility to address issues within a wider context, therefore this type of environmentally responsible design cannot be effectively considered within the current socio-economic development system.

These definitions of environmentally responsible design are explored in more detail in the following sections.

2.6.2 Green design

The US Congress, Office of Technology Assessment (OTA 1992) defines 'green design' to mean:

'a design process which environmental attributes are treated as design objectives, rather than constraints', and that 'the two general goals for green design should be waste prevention and better materials management and designing for service and maintainability to extend product life, both reduce the generation of waste.' (page 7)



Source: OTA (1992)

Figure 2.6

Waste management addresses the activities of manufacturers and consumers that avoid the generation of the waste in the first place. It involves green design approaches such as 'light-weighting' - using less materials to perform the same function. Activities that relate to utilising materials in their highest value application through reusing and recycling, refer to the goal of better materials management. Here concepts such as design for disassembly, easy separation of materials or the capability of recycling constituents are useful techniques to designers reducing the overall amount of material used and waste produced. Two books were published in 1991 and are key introductory texts to 'green' design as it emerged from the 1980's. Both texts comprehensively address the issues associated with green design and have laid the foundations for further work in this area in the UK. The first of these is Dorothy MacKenzie's book, *Green Design: Design for the Environment*. In this she outlines the green design debate and the choices the designer is asked to make during the design process:

'For many years designers have been asserting their influence and demonstrating the power of design. The new demands of designing for minimum ecological impact will provide an ideal platform from which designers can justify their claims and acknowledge their responsibilities.' (page 10)

MacKenzie uses case studies to highlight a variety of initiatives ranging from those focusing on waste and material reduction to those addressing alternative energy sources. She explains Cradle to Grave¹ approaches to design and the difficulties in using Life Cycle Analysis (LCA)² as an exact tool for measuring and comparing environmental impacts. Paul Burall wrote the second green design text, *Green Design*. Burall specifies a checklist for achieving a more socially responsible design ethic. He places this within a greener management framework such as that portrayed by 3M and Philips:

'Like 3M, Philips has set up a central unit to provide environmental expertise ... keeping abreast of the environmental situation world-wide. The guiding principle is "prevention is better than cure".' (page 19)

Burall sees one of the main design objectives as building in as much flexibility as is reasonably possible into the design at the beginning in order to assist incremental improvements throughout the product life. He stresses the importance of not shifting the environmental problem to elsewhere on the global system through redesign. An example he gives of transferred environmental damage focus is the design of electric cars. Although the immediate air pollution problem is lifted from the local area in which electric cars are used, the pollution produced from building the fossil-fuelled stations needed to charge the electric car batteries means the

¹ **Cradle to Grave** - an approach to design where the environmental impacts of a product are considered across the whole lifecycle, from raw material acquisition to end of life disposal.

² **LCA tools** present the lifecycle environmental impacts of a product which enable the designer to make relative comparisons of the environmental impacts of the same product using different materials/ energy sources/ methods of production etc.

environmental impact is shifted geographically - it is still enclosed within the global system. In this case Burall suggests that the use of renewable energy sources such as solar power, could be used to provide electric power to charge the car batteries and thus the transfer of environmental impacts would be eliminated.

Green design initiatives focused primarily on 'end-of-pipe' clean up processes within manufacturing industry. Increasing concerns over direct pollution effects on air, water, and soil quality instigated new environmental legislation and standards to support cleaner technologies. Action then progressed to achieving 'cleaner' manufacturing process technologies with the prime aim of achieving less production waste and greater material and energy resource efficiency.

As this area matured it became evident that it would also be necessary to address product environmental impacts as well as those associated with the manufacturing process. Many industries have achieved some awareness in this area but the majority of issues have focused on a single environmental impact only; this may or may not be the main environmental impact for that particular product. It is often the case that the 'easiest' environmental action is associated with this type of 'green' design', e.g. packaging redesign of an intrinsically environmentally polluting product. (own research 1993-1995 - see Chapter Six, 6.3.3 (b), p147). From taking this sort of action some companies then advertised the 'green' credentials of their product which caused confusion with the consumer. These marketing-oriented green products did little for the credibility of genuine green designs. (Potter and Roy, 1994)

Green design is 'product' based and focuses on one or two, often 'high profile', environmental impacts such as the recycling of packaging materials or the elimination of toxic materials. Ecodesign evolves on from this basic design approach to address environmental impacts across the complete life-cycle of the product, from production to disposal; at this level the design approach is looking at the design, production and commercial system.

2.6.3 Ecodesign

'design which addresses all environmental impacts of a product throughout the complete life cycle of the product, without unduly compromising other criteria like function, quality, cost and appearance'

(ECO₂-irn, 1994).(Dewberry & Goggin 1995)

Ecodesign prioritises environmental problems and pulls together all aspects of these single and multiple environmental focus 'green' design areas to address criteria across a broader picture - the entire product life cycle - thus generating the potential for real environmental gains.

At a 'minimum' level it complies with the characteristics of 'green' design across multiple issues of environmental impact and product life cycle. At a 'higher' level ecodesign questions the functionality, quality and appropriateness of a product and may well address issues such as upgradeability, reusability and the product person relationship.

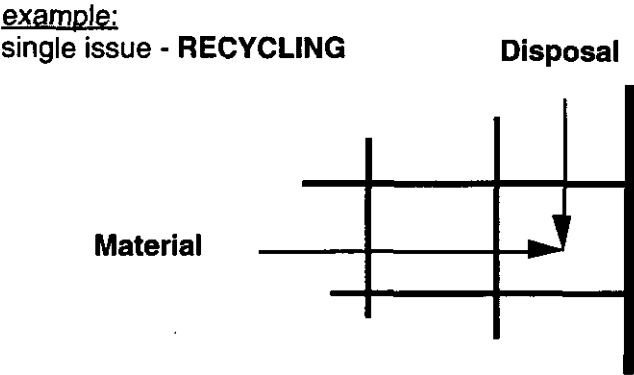
It is possible to describe some of the different environmental areas that would need to be tackled by a comprehensive ecodesign approach. An ecodesign matrix (developed by Dewberry and Goggin 1995) graphically represents the environmental life cycle analysis of existing material goods (Figure 2.7). Here a typical product life cycle from production through to end of life disposal is shown against one axis, with environmental impacts placed on the corresponding axis. The main environmental criteria are identified as raw material inputs, energy requirements and pollutants. Using this representation of ecodesign it is possible to indicate the relationship between particular design approaches - such as recyclability and energy efficiency etc. - in the overall drive to reducing environmental harm.

Clearly, if ecodesign is concerned with the complete product life cycle and all primary environmental pressures, then single issue attempts to reduce environmental impacts such as design for recyclability or designing products that use recycled, non-toxic or less materials, cannot be regarded as ecodesign, but rather as constituents of ecodesign. (see Figure 2.7)

Ecodesign falls between, at the lower level 'green' design and at the higher level, 'sustainable' design. (see Figure 2.5). Ecodesign incorporates both of these approaches to some degree. (Dewberry and Goggin 1995) An ecodesign strategy can be applied to any product irrespective of cultural values, local environmental priorities or whether such a product group is globally sustainable in the long term. It does not go so far as to question the basic need for the product and thus does not question current cultural values as a sustainable product design approach would aim to do.

Life Cycle of Product

		Production	Use	Disposal
Environmental Impact	Energy <i>eg. efficiency, alternative</i>	More efficient production processes, reducing distribution transport.	Reducing energy consumption of products. Alternative power supplies	Non- energy intensive disassembly. Appropriate disposal.
	Material <i>eg. virgin, recycled, minimisation</i>	Minimising use of raw material. Eliminating deleterious materials.	Design for quality, reducing need for new material for repair	Design for disassembly. Cascading material cycles acknowledged.
	Pollution <i>eg. solid waste, air emissions, water emissions.</i>	Reducing production waste. Eliminating toxic's	Eliminate hazardous emissions and the need for 'throw away', short term additions.	Appropriate disposal regarding grade of waste. Landfill last option!



.... a focus on one part of the ecodesign matrix

(Dewberry and Goggin 1995)

Figure 2.7

Ecodesign can be viewed from a number of perspectives, the two most commonly discussed are the ‘product based’ perspective and the ‘system based’ perspective. For example, the product perspective would suggest material or energy improvements to the design of a washing machine to reduce environmental impacts whereas a systems approach would first consider the requirement for washing clothes and alternatives for meeting this requirement that generated fewer adverse environmental impacts over the whole life cycle, e.g., community laundry facilities, or the design of textiles that required no ‘wet’ cleaning. The latter is more in line with a sustainable design approach.

To date the majority of ecodesign initiatives have focused on the product where changes to reduce the environmental impact of the product do not alter the current industrial and social infrastructure.

The product perspective incorporates initiatives such as resource conservation -minimisation (of materials / energy & all natural resources), appropriate amalgamation of materials, reuse, regeneration, recycling, longer life. A focus on one or two of these initiatives relates to a green design approach whereas a focus addressing the environmental impacts across the whole life cycle would relate to an ecodesign approach. Manzini (1994) described both of these as 'normalised ecological design'; environmental design initiatives that could be incorporated within current industry practice without a radical change in attitudes and behaviour:

' "normalised ecological design" where the environmental issue penetrated mature industrial societies/ affecting various social actors, leading to new policies, corporate programmes, new demand for environmental quality in the marketplace.' (page 37)

Ecodesign initiatives do not effect the 'stable social and industrial framework, they do not require difficult changes in lifestyles or changes in the overall industrial and economic growth model. This type of environmental design initiative can encourage, to some degree, a change in consumer behaviour, through, for example, product information, a focus on cost savings by saving energy (Energy labelling, Ecolabels). However, the structure of our existence is not questioned and although these environmental initiatives are important, they, in themselves, are not sufficient for sustainable development. For this to happen requires questioning at an international level of social, economic, political and ethical models. Manzini (1994) sees this as a 'structural crisis' where the global model of development is the true issue under discussion ..(a move towards a systematic, sustainable design approach).

'it becomes increasingly clear that the scenario of the "redesign of what exists" is not sufficient for the discovery of true solutions.' (page 38)

Sustainable design is not only concerned with the technical aspects of product development but also with cultural, social, marketing and economical aspects. Manzini noted that the task of environmentally sensitive design is to combine what is technically possible in the field of clean technologies, with what is culturally and socially desirable in the field of the growing environmental awareness - the designer cannot only positively influence the production process but also the consumption process.

2.6.4 Sustainable design

'Sustainable product development considers the intensity and optimisation of resource use for product design, whilst developing concepts within whole systems, that provide a service or function to meet human needs.'

(van Weenan 1994)

'Sustainable Product Design (SPD) is a design management practice which has as a key element the need to ensure that environmental, social and economic needs are balanced.'

.... SPD is a systems-oriented approach that recognises the need to form broader stakeholder relationships and partnerships. The aim is to produce zero emissions.'

(A Chick & M Charter, 1995)

Sustainable design goes beyond the principles of ecodesign as it attempts to satisfy design problems within the wider framework of sustainable development³. Ecodesign, as has been described, can be applied to any product or system regardless of the 'need' or usefulness' or appropriateness' of the product or system - it can be utilised as a techniques for creating more responsible design within our current production and consumption patterns. Sustainable design however, aims to look beyond the accepted parameters of the design process and address an extended range of external factors currently 'outside' the design remit. Charter (ed., 1992) identifies key elements in sustainable product development as:

- Functionality
- Taking account of social, human and environmental factors
- Generating eco-solutions, solving eco-problems
- Reduced and more efficient use of resources: eco-efficiency
- Working with nature, not against it
- Systems-oriented
- Stakeholder-oriented
- Minimising environmental impact across the product life-cycle
- Holistic
- Zero emissions

In sustainable design the focus will be to move away from product to a systems based approach. Concepts such as de materialisation (Bernardini and Galli, 1993; O'Riordan, 1971); the move away from hardware to software; ideas to achieve more from less; and an onus on service as opposed to ownership - all raise the question of how design roles will alter to accommodate such a 'radical' change. (Dewberry and Goggin 1995)

Sustainability as a target for designers consists of a broad range of external material and cultural factors; the commonly accepted '20' factor⁴ which says that we must reduce global consumption by a factor of 20 in the next 30 years has profound implications for design and addresses the inequality between the industrialised and developing regions:

'for the 26% of the world's population who live in the industrialised countries consume, for example, 80% of the world's commercial energy, 79% of its steel, 86% of its other metals and 85% of its paper. And they generate 92% of all industrial CO₂ emissions.'

³ **Sustainable Development** means living on the earth's income rather than eroding it's capital. It means keeping the consumption of renewable natural resources within the limit of their replenishment. It means handing down to successive generations not only man-made wealth, but also natural wealth, such as clean and adequate water supplies, good arable land, a wealth of wildlife and ample forests. (UK's Environment White Paper, 1990)

⁴ The '20' Factor states that collectively we must reduce global resource throughput by a factor of twenty in the next thirty years or so and in order to achieve this then global consumption patterns must alter dramatically. (Manzini 1994b)

In the context of global resource management van Weenen (1994) states that:

'the nature and volume of production and consumption will receive increasing attention. In product development more emphasis will be put on questions regarding actual needs and wants, required functions and new environment oriented and creative ways of meeting acknowledged and respected demands. Subjects as elementary needs, life cycle design, product durability, long term resource availability and natural compatibility, will be central to the concept of sustainable product development.'

The growing demand for 'western' lifestyles, the erosion of national boundaries and culture and the implications of the information age. These all have a dramatic effect on design and although ecodesign fits into this move towards sustainability it has many limitations in this context.

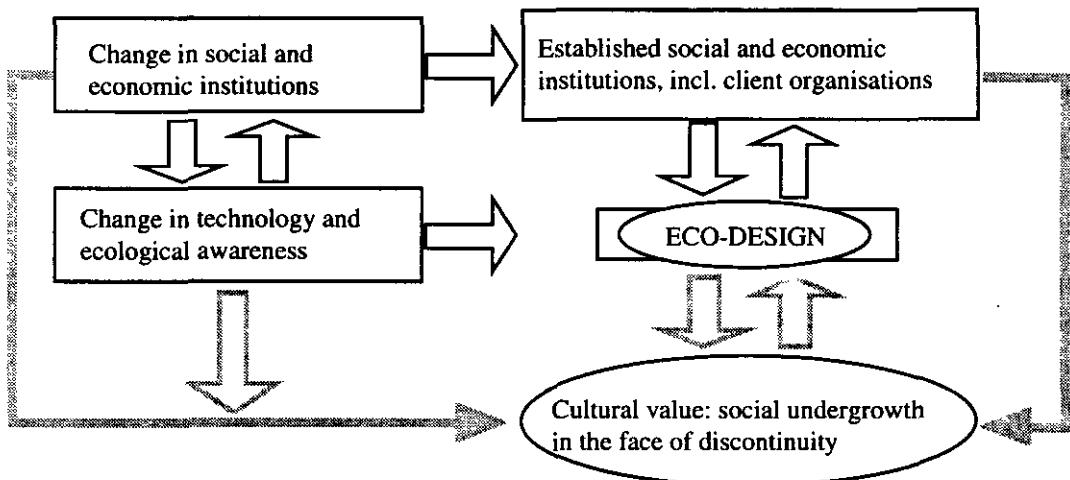
'... the wide-spread sensation, even in the most industrialised nations, that what is actually taking place today is actually a structural crisis, and that the global model of development is the true issue under discussion' ... 'The aim is not to find "the solution" for all questions: the idea, more modestly, is to propose solutions which contain some spark of innovation, meaning a new way of behaving or viewing the world.'

(Manzini 1994)

Ainamo (1993) notes that the ecosystem is effectively a closed system and that there is currently an imbalance between the use and replenishment of resources in the ecosystem. He suggests that this 'imbalance' can be rectified, albeit slowly, through collaboration with the various actors involved; the manufacturer, the government and the community. He sees the industrial designer as a mediator within the ecosystem with the capability to communicate between the parties to promote responsible ecological action. (see Figure 2.8)

'Anyone can attempt to take into account all the needs of the totality of ecology but this can never be fully achieved. Attempts are bound to be contradictory, because different attempts are based on different perceptions of ambiguity, complexity and change'

(Ainamo 1993)



2.6.5 Design for environment (DFE)

Within 'levels' of environmentally responsible design different terminologies exist. The language in the field of environmentally responsible design has evolved rapidly since the late 1980's. From the beginnings of 'green' design and 'environmentally friendly' products we have progressed to viewing the subject in a much wider context; a global context. The terminology has also been effected by geographical location. For example, in the USA the generic term, Design for Environment (DFE), is very popular. Under this there are more focused terms such as Design for Disassembly, Design for Energy efficiency / Conservation, Life Cycle Design and so on. In Australia the terms 'Eco-design' and 'Eco-redesign' are commonly referred to [Ryan et al 1992c)] whereas in Holland, Germany, Italy and the UK a mixture of all these terms exist. Today researchers in this area are beginning to refer to a global system and address a responsible design ethic as sustainable design within the context of industrial ecology.

Terms such as 'Design for Quality' or 'Design for Manufacturability' are now commonplace within manufacturing industry and have been integrated within design thinking for a number of years. Design for Environment terminology transcends the barriers associated with other eco product terms due the already familiar phrase 'design for' This is useful in integrating ecoproduct philosophies within design development and manufacturing practices and can be seen as a series of 'stepping stones' from green design towards achieving the more holistic approach of sustainable design.

Dorothy MacKenzie highlighted this point of familiarity with terminology at the Centre for Sustainable Design Conference in 1995. She said:

'Eco-Design is an overwhelming concept, about which we still lack knowledge and understanding. The temptation is to use this as a reason for ignoring it. However, Design has had to take on many new aims in the past, such as Design for Manufacturability. The selection of specific aspects of Eco-Design as an initial focus, using the "Design for X" approach can help to interpret the concept in a manageable way.'

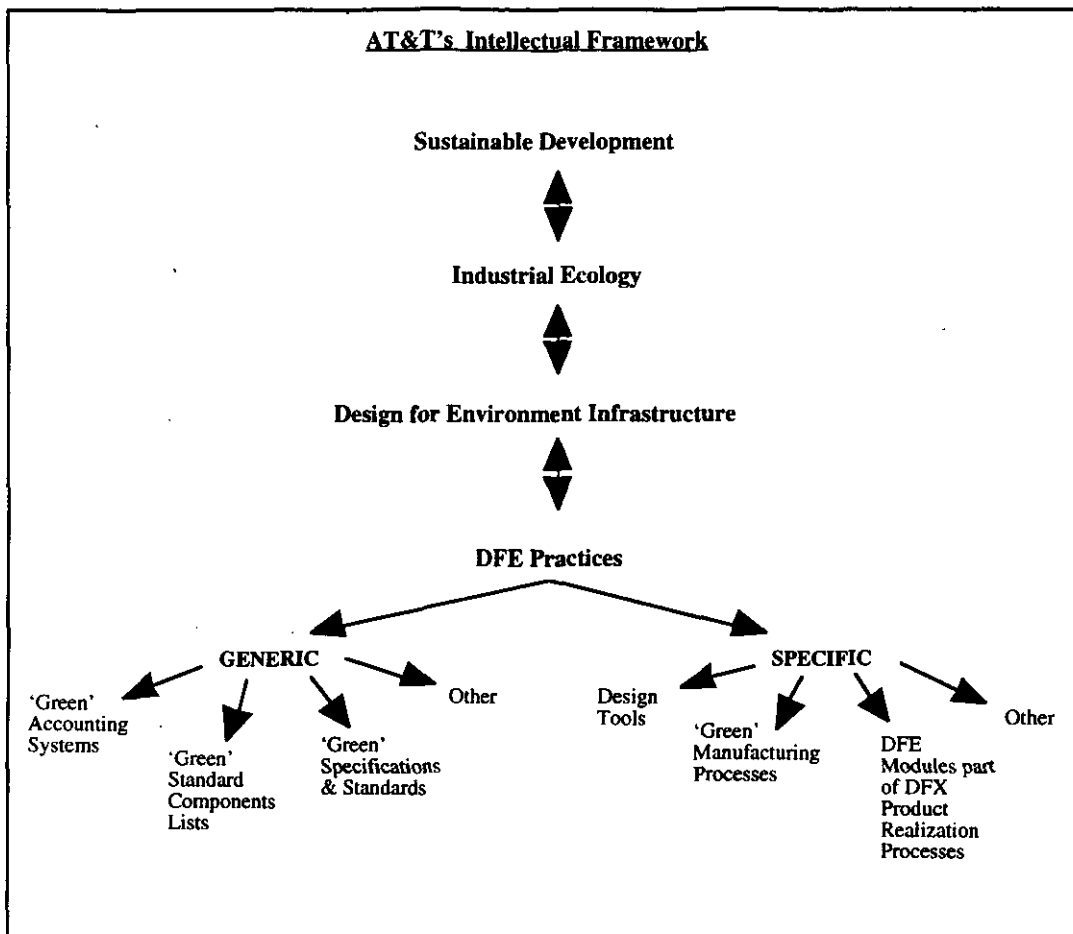
DFE has been integrated into industrial ecology⁵ concepts originating from the USA (particularly from companies like AT&T). DFE is the umbrella term for both generic and specific practices relating to environmental responsible management, design and manufacture.

'Design for Environment designates a practice by which environmental considerations are integrated into product and process engineering design procedures. DFE practices are meant to develop environmentally compatible products and processes while maintaining product price/performance and quality standards.'

(B Allenby & A Fullerton, AT&T, 1991)

The Structure of AT&T's industrial ecology framework can be seen in Figure 2.9.

⁵ **Industrial Ecology** is a new multi-disciplinary field and refers to the integration of technology and environment throughout our economy (Guus van Dijk 1995)



After Guss Van Dijk (1995)

Figure 2.9

AT&T maintain that the imperative for the successful implementation of an environmental management system with industry is to devise comprehensive models that can easily be defined and applied within current design practices.

2.7 Approaches to environmentally responsible design

There are also a number of categorisations of environmentally responsible design approaches. These approaches are highlighted in Tables 2.2 and 2.3.

Van der Horst and Zweers (1993) identify the benefits and drawbacks of a number of different design approaches in Table 2.2

Type of Approach	Benefits	Drawbacks
<i>'closing materials cycles'</i>	Provides useful criteria from which to work	contradictions, possibilities of increase in pollution, lack of info. on recycled materials.
<i>energy indicators</i>	Environmental decisions translated into one measure	Few energy indicators on reuse and recycling processes.
<i>hazardous waste</i>	Increases the demand for info. on toxic materials	Too restricted an approach, excludes other elements such as those mentioned above.
<i>life cycle analysis</i>	Sound philosophy behind the LCA concept - for real environmental improvements within products, all forms of pollution caused by the product throughout its whole life-cycle must be considered.	Lack of reliable environmental info. on material and processes means that the method must be applied with caution.
<i>environmental-economic</i>	Environmental consequences translated into environmental costs provide both designer and company, working with cost as a unit, with sound guidelines.	Difficulties in how environmental costs are calculated. Also requires considerable effort to construct an inventory all crucial environmental entries, as with LCA.
<i>environmental marketing</i>	Can result in companies responding to current environmental developments - it is the market that determines the environmental criteria.	There have been a number of cases where dubious environmental claims have been used for marketing purposes
<i>environmental legislation</i>	Environmental legislation is developing rapidly. There are strict guidelines for the designer to follow. May encourage 'tentative' pro-activeness where a company may try and predict future legislative developments.	Produces a reactive response from companies where changes to the product have to be implemented in a hurry. National legislation may lag behind international standards and companies would find themselves at a competitive disadvantage.
<i>conceptual</i>	Analyses the product from an environmental perspective in the context of sustainable development. Can produce far reaching environmental improvements in products.	Hard to realise in design practice - actually questioning the existence of a particular product.

Source: Van der Horst & Zweers (1993)

Table 2.2

In Table 2.3 Roy (1994) presents a range of design approaches associated with different environmental focuses and illustrates design examples of each approach.

Categorising greener products by their principle environmental focus and design approach

Environmental Focus	Design Approach	Examples
Products that reduce fossil fuel consumption	High energy efficiency	Energy saving refrigerators; Compact fluorescent lamps; Condensing boiler
Products that reduce natural resource consumption	Use less materials or other resources	High performance rechargeable batteries with integral charger for low voltage commercial lighting; Concentrated detergents in refillable packs
	Made from recycled or waste materials/ components	Road repair material made from used car tyres; Packaging made from recycled plastics; Garden and street furniture made from recycled plastic waste
	Made from renewable materials and sustainable sources	High quality furniture made from forestry thinnings; Timber from sustainably managed forests
	Designed for durability, repair and maintenance	Classic designs - clothes, automobiles, watches
	Designed for reuse, refurbishment, remanufacture or recycling	High quality printer toner cartridges remanufactured from used cartridges. Computer mainframes designed for disassembly. Car bumpers made from recycled plastic from car dashboards
Products that reduce pollution and damage to ecosystems	Reduces use of toxic, hazardous or ecologically damaging chemicals /materials	Aerosols which operate on compressed gas rather than hazardous liquid propellants; Low CFC refrigerators; Phosphate-free detergents
	Pollution monitoring and control equipment	Water pollution control monitoring equipment; Cyclonic diesel engine exhaust cleaning system

Note: Some products may fall into more than one category Source: Roy (1994)

Table 2.3

Both tables 2.2 and 2.3 identify a range of design approaches from green design and ecodesign. The former relates to one or two design approaches while the latter relates to a combination of all design approaches addressing environmental impacts across the entire life cycle.

Moving beyond ecodesign, Table 2.4 presents a comparison of the characteristics of conventional design and those of environmentally responsible design. The focus of environmentally responsible design ranges from single issues such as energy and materials to more complex systems questions of sustainability. (van der Ryn & Cowan, 1996).

Characteristics of Conventional and Sustainable Design

Issue	Conventional Design	Sustainable Design
Energy source	Usually non-renewable and destructive, relying on fossil fuels or nuclear power; the design consumes natural capital	Whenever feasible, renewable: solar, wind, small-scale hydro or biomass; the design lives off solar income
Materials use	High-quality materials are used clumsily and resulting toxic and low-grade materials are discarded in soil, air and water	Restorative material cycles in which waste from one process becomes food for the next; designed-in reuse, recycling, flexibility, ease of repair and durability
Pollution	Copious and endemic	Minimised; scale and composition of wastes conform to the ability of ecosystems to absorb them
Toxic substances	Common and destructive, ranging from pesticides to paints	Used extremely sparingly in very special circumstances
Ecological accounting	Limited to compliance with mandatory requirements like environmental impact reports	Sophisticated and built in; covers a wide range of ecological impacts over the entire life-cycle of the project, from extraction to final recycling of components
Ecology and economics	Perceived as in opposition; short-term view	Perceived as compatible; long-term view
Design criteria	Economics, custom and convenience	Human and ecosystem health, ecological economics
Sensitivity to ecological context	Standard templates are replicated all over the planet with little regard to culture or place; sky-scrapers look the same from New York to Cairo	Responds to bioregion; the design is integrated with local soils, vegetation, materials, culture, climate, topography; the solutions grow from place
Sensitivity to cultural context	Tends to build a homogeneous global culture; destroys local commons	Responds and nurtures traditional knowledge of place and local materials and technologies; fosters commons
Biological, cultural and economic diversity	Employs standardised designs with high energy and material throughput, thereby eroding biological, cultural and economic diversity	Maintains biodiversity and the locally adapted cultures and economies that support it
Knowledge base	Narrow disciplinary focus	Integrates multiple design disciplines and wide range of sciences; comprehensive
Spatial scales	Tends to work at one scale at a time	Integrates design across multiple scales, reflecting the influence of larger scales on smaller scales and smaller on larger
Whole systems	Divides system along boundaries that do not reflect the underlying natural processes	Works with whole systems; produces designs that provide the greatest possible degree of internal integrity and coherence
Role of nature	Design must be imposed on nature to provide control and predictability and meet narrowly defined human needs	Includes nature as a partner: wherever possible, substitutes nature's own design intelligence for a heavy reliance on materials and energy
Underlying metaphors	Machine, product, part	Cell, organism, ecosystem
Level of participation	Reliance on jargon and experts who are unwilling to communicate with public - limits community involvement in critical design decisions	A commitment to clear discussion and debate; everyone is empowered to join the design process
Types of learning	Nature and technology are hidden; the design does not teach us over time	Nature and technology are made visible; the design draws us closer to the systems that ultimately sustain us
Response to sustainability crisis	Views culture and nature as inimical, tries to slow the rate at which things are getting worse by implementing mild conservation efforts without questioning underlying assumptions	Views culture and nature as potentially symbiotic; moves beyond triage to search for practices that actively regenerate human and ecosystem health

Source: van der Ryn & Cowan, (1996)

Table 2.4

2.8 Life cycle design

A number of design methodologies have been developed to achieve design with reduced environmental impacts. The great majority of these are based on LCA which is a specific methodology rooted in a systematic life cycle approach.

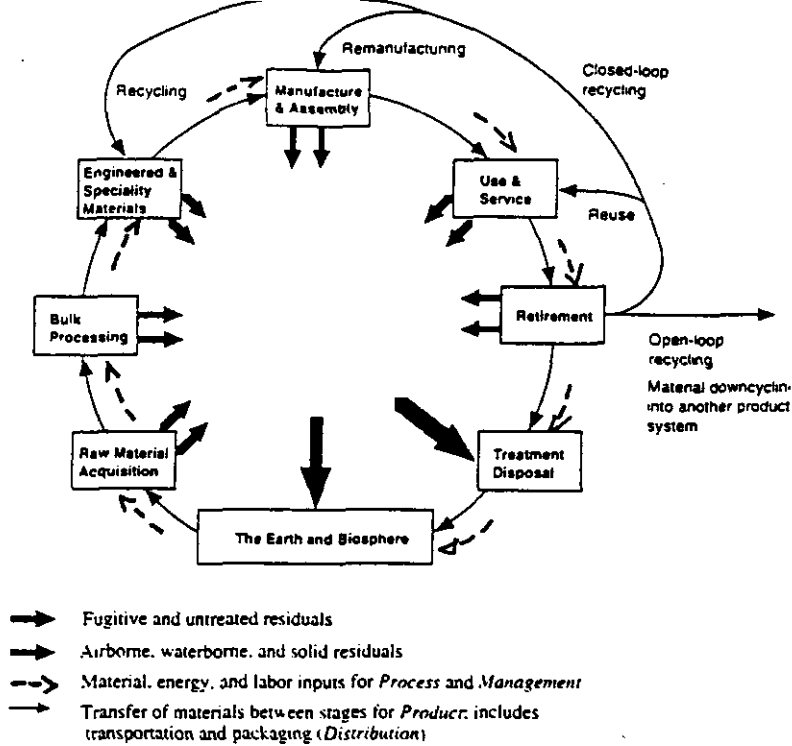
The prime objectives of carrying out a LCA are:

1. to provide as complete a picture as possible of the interactions of an activity with the environment;
2. to contribute to the understanding of the overall and independent nature of the environmental consequences of human activities; and
3. to provide decision-makers with information which defines the environmental effects of these activities and identifies opportunities for environmental improvements.

(SETAC 1993)

LCA uses what is known as a cradle to grave approach - all environmental impacts are considered throughout the whole life cycle of the products; from raw material acquisition to the final disposal of waste. It aims to evaluate the energy balance and material flow of any product or service system. LCA is a widely recognised environmental design methodology and has been used to support environmental policy development (e.g. EC Eco-labelling Scheme) (PA Consultancy 1992), and the environmental claims of some companies products (e.g. washing machines, diapers and light bulbs). Figure 2.10 indicates the cyclic nature of material and energy flows through a product life cycle (Keoleian & Menerey, 1994). The figure shows that a product life cycle can be organised into the following stages:

- raw material acquisition
- bulk material processing
- engineered and speciality materials production
- manufacturing and assembly
- use and service
- retirement
- disposal

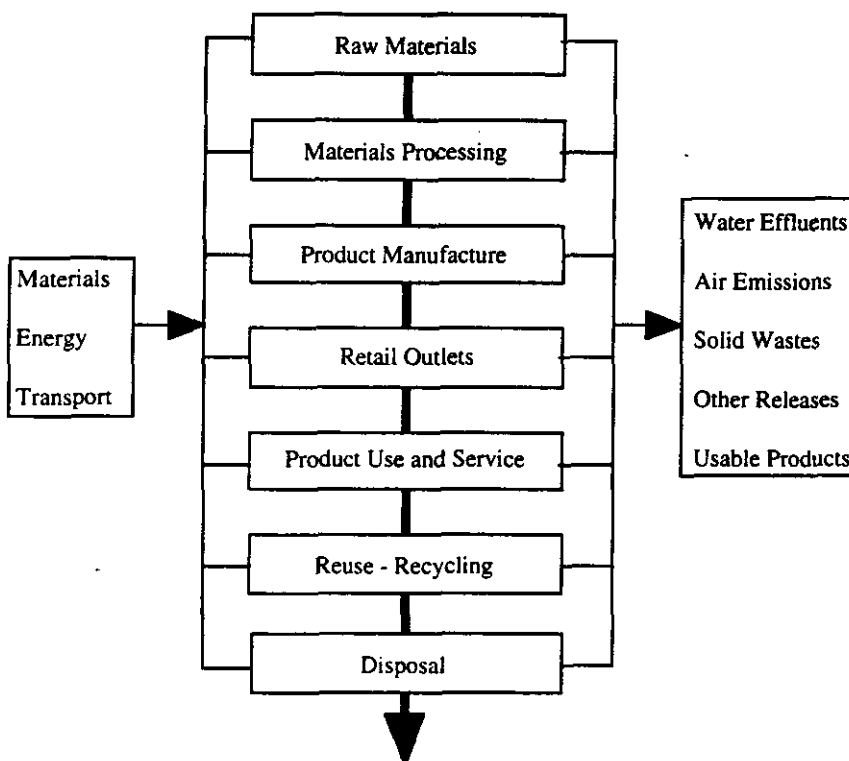


Source: Keoleian & Menerey (1994)

Figure 2.10

The life cycle system is extremely complex but the life cycle assessment (LCA) framework (Figure 2.11) shows a simplified version demonstrating the essential elements and relationships in the LCA.

The life cycle assessment framework



Source: The SETAC LCA Framework (1993)

Figure 2.11

Holloway et al, (1994) point out that to undertake LCA studies it is important to follow a number of guidelines:

- Define systems boundaries at the outset
- Study completely the system and subsystems involved in the process being assessed
- Produce a flow chart of all processes and attempt to 'close the loop'
- Carry out very thorough investigations to obtain all relevant data
- uses an agreed and fully developed system data interpretation
- Present the results in a transparent way which is understandable to all parties concerned and assists integration into the design process

There are a number of difficulties associated with LCA. A major problem is the collection of enough detailed and accurate data within the time and cost parameters of a design project. The complexity of the sub-systems within most LCA's is also a major barrier to obtaining accurate information from which to design out environmental impacts. (SETAC 1993) An environmental impact analysis may contain a number of product systems which are all intimately entwined; for example, the by-products of one process that may well be used as raw materials for another. This complexity makes the task of analysing the whole life-cycle extremely time-consuming, cost intensive and prone to inaccuracies. One of the most difficult concepts of LCA the trade-off of one environmental impact for another (e.g. does the energy consumed in the production of plastics packaging have a greater environmental impact than the disposal of the packaging at the end of life?) Such decisions are dependent on immediate external issues, for example, with reference to the above packaging question, is the energy source production fossil fuel or renewable (hydro?), is disposal focused on municipal waste disposal or recycling collection schemes?... The whole analysis solution will change as these external factors also change and so it is imperative that one LCA solution, for example, for plastics packaging, is not seen as being 'the solution' for all plastics packaging. However, it may be impractical for companies to carry out their own LCA assessments from first principles (costs and time involved in doing this). Pre-calculated data on raw materials, different processing operations etc. is needed in order for companies to construct a life-cycle of their specific operations.

LCA is a rapidly evolving field. Probably it's most useful application at the present time is as a comparative tool for addressing a range of design alternatives. Such studies can highlight the main environmental impact areas of product groups which designers can then address with this 'ball-park' information. For example, the focus of the automobile industry on the recycling of car parts might be a 'misplaced' given that it is not an area of prime environmental damage compared with the emissions produced from the type of motor used to drive the vehicle. But motor power is a more 'radical' area to focus on, unlike that of 'recycling'

Questions arise on how to integrate environmental decision criteria within the design process. This can be an extremely difficult process because the designer is often dealing with conflicting information and the impossible task of 'measuring' environmental impacts, trading one off with another. A number of decision making tools have been designed in recent years, many of them in the form of computer software, and all of them based around the concept of a Life-cycle analysis approach. Holloway et al, (1994) have developed a table which identifies the range of data reference material and analysis tools available to aid LCA assessments:

Database / LCA model	Data coverage	Features
EPS (Ryding and Steen)	General	Computer-based LCA software using Environmental Priority Strategies (EPS). EPS is used to define indices from which the environmental impact of a product or system can be calculated and presented in a quantitative form. (Environmental Load Units - ELU)
IDEA (Y. Virtanen)	Large systems studies such as recycling, trade	Very large and comprehensive database. Operating under database IV data represent Western averages in 1990. Features material manufacture, transport and energy conversion
LCA Inventory Tool (Rydberg and Svensson)	Packaging	Computer-based tools for formulation and calculation of product life-cycles. Only selected data included but extra data may be purchased separately. Calculation achieved by construction of flowcharts
PEMS (ARA International)	General	PEMS (PIRA Environmental Management System) is a spreadsheet-database LCA program. The model is intended for use by a range of companies and contains a large amount of data.
PLA (Danish Technical University)	General	Lifeway software tool was developed as part of an educational programme. Intended for use by non-academics co-operating with external experts. Intended to be developed into fully fledged expert system
SimaPro (Guinée et al)	General	Developed by Pré Consultants Ltd in the Netherlands, this is probably the most widely used LCA data model. Computer-based and helps designers to compare different alternatives on an environmental basis. Most data are taken from BUWAL and Van den Burgh and Jurgens

Source: Holloway et al, (1994)

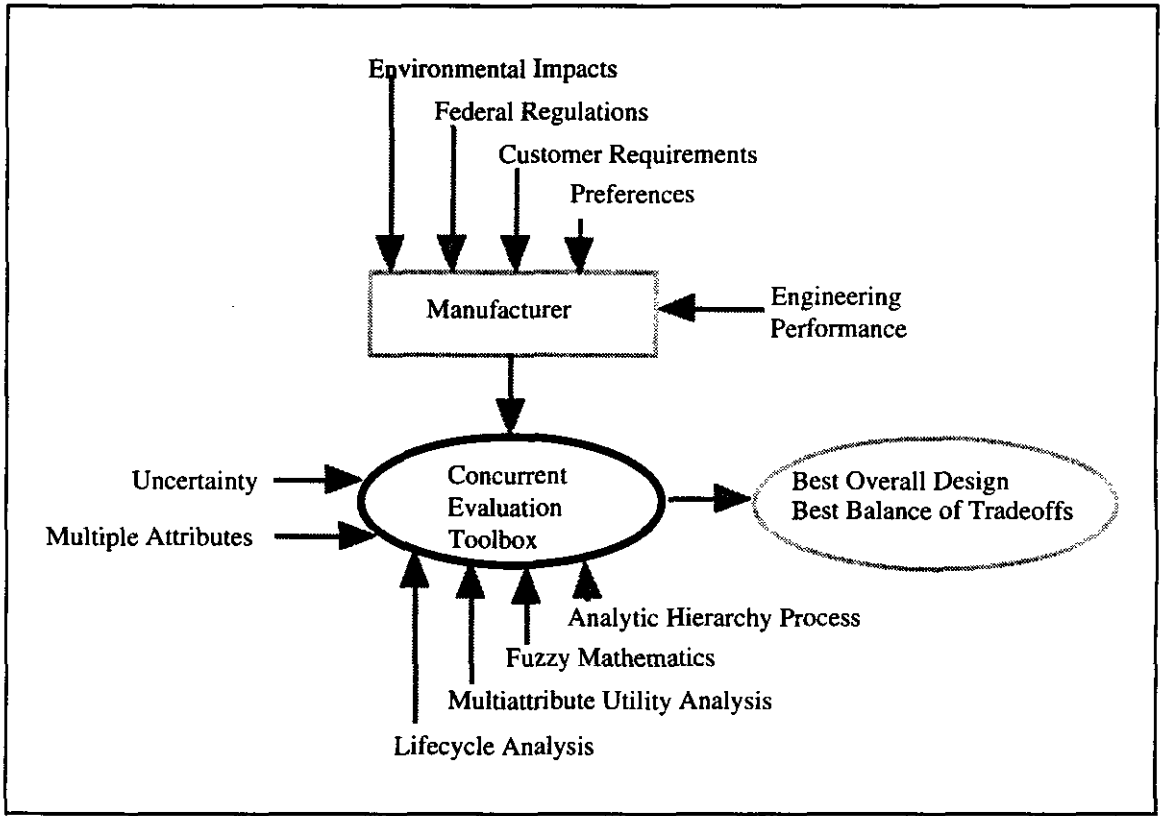
Table 2.5

Practically incorporating an LCA approach within the design process is a problem as trade-offs between environmental impacts, engineering performance and customer satisfaction are unavoidable in the design process. Thurston (1994) discusses a method of making these trade-off decisions. Firstly it is necessary to use a life-cycle analysis approach to ascertain the environmental impacts of a (product or system) by focusing on a comparative approach ('ball-park' environmental impact analysis) rather than detailed data environmental analysis approach of design alternatives. Thurston (1994) developed an evaluation-driven design analysis methodology which incorporates the trade-offs between multiple attributes into the design decision-making process; this is illustrated in Figure

2.12. The aim of the analysis methodology is to view the design artefact as a bundle of non-measurable attributes throughout the process. The end result is the determination of the *overall values* of each design alternative- it enables abroad overview of the impacts of each possible design solution. The best balance of trade-offs will also be dependent on externalities such as customer and regulatory responses to environmental problems.

'The concurrent multi-attribute design evaluation will include the cost of compliance with existing and anticipated environmental legislation, in addition to, or in place of, the relative environmental impact itself. Thus, the 'internalisation of externalities' will be reflected.'

Figure 2.12 illustrates this method of integrating external and internal impacts directly into the design decision-making process . These impacts are evaluated simultaneously at the concept stage of the design process in order that the 'best' design alternative is chosen.

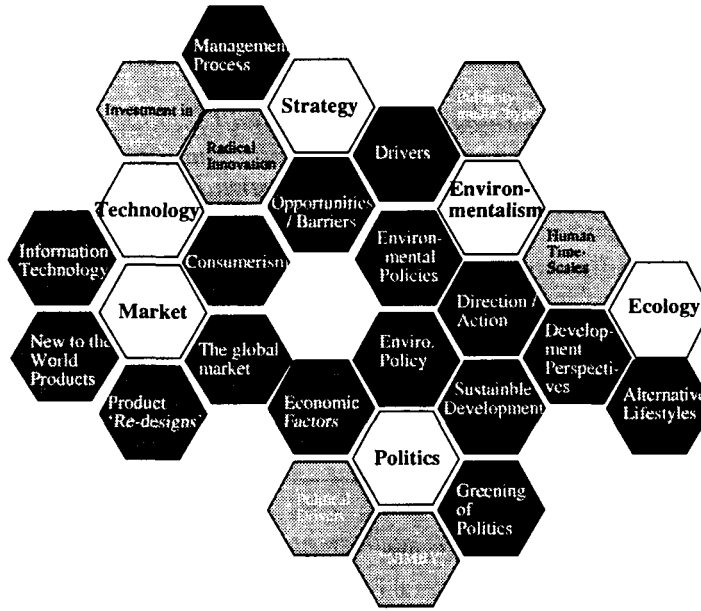


Source: adapted from Thurston (1994)

Figure 2.12

Concurrent engineering offers the best opportunities for environmental criteria to be successfully incorporated within the design process. (Holloway et al, 1994). It ensures that designers simultaneously consider all elements involved in product design - from function and cost through to quality and environmental considerations.

2.9 Strategy, policy and market considerations



2.9.1 Strategy

Environmental management strategies are continually evolving alongside strategies for eco-design and manufacture. The introduction of environmental criteria into business management will move industry towards a more holistic, systematic and integrated manufacturing approach, addressing the environmental impacts that its products and services cause. A manufacturing strategy provides a vision for the manufacturing organisation based on the business strategic plan. It consists of objectives, strategies and programs which help the business gain, or maintain, a competitive advantage (Roome 1994). Sarkis (1995) lists a number of business strategies that explicitly and proactively include and address environmental issues:

- reduce consumer scepticism by forming alliances with environmental groups, regulators, retailers and academia;
- practice pollution prevention at the source;
- stay ahead of current, and anticipate future, environmental standards;
- avoid doing business with suppliers that take ecological shortcuts;
- make every individual in the organisation assume responsibility for environmental protection;
- take preventative and corrective environmental action;
- measure for environmental impact;
- promote self-organising systems by empower in people to act to prevent pollution.

Roome (1994) identifies four corporate strategic options for companies to take in response to the environmental challenge:

1. *non-compliance*: although often illegal this stance is adopted by some companies on some occasions;
2. *compliance*: the company aims to meet legal standards or industry guidelines. A compliance strategy revolves around a reactive approach where the company is continually trying to 'keep up' with increasing legislation;
3. *compliance plus*: a strategy incorporating environmental management systems into business structures; this will imply meeting legislation as a matter of course and even anticipating new regulations;
4. *excellence*: the best in the industry, acting pro-actively; by implication this is the much-to-be-preferred corporate approach, associating excellence with commercial excellence.

Whilst pollution control legislation and the development of environmental management standards will encourage a reduction in environmental degradation, it is unlikely that they will guarantee a more sustainable outcome. For this to be a reality it is necessary to identify other elements which are essential to sustainability, including:

- reduction on dependency on non-renewables;
- alternatives to short term profit motives;
- working within ethical and social frameworks.

Welford (1994) summarises three guiding principles which we would find in the sustainable organisation as:

1. Accountability
2. Transparency and openness
3. Education and learning

These he points out as the 'general principles'. He also identifies three elements to the sustainable development paradigm:

Environmental protection;
Equity;
Futurity.

An auditing methodology that is consistent with sustainability must recognise and assess an organisations approach towards biodiversity and animal protection and place an emphasis on human rights and the protection of indigenous populations. It must also address the concept of 'sustainable development is local action' and focus on participatory and community strategies and the scale of operations.

Environmental auditing is not a new concept (Gray 1993) and Welford & Jones (1994) outlines five levels of auditing in Table 2.6. The first, most basic approach, is *compliance*

auditing where performance is measured as conformance to legislation, regulation and codes of conduct. The last level fully incorporates the understanding for a clear ‘paradigm shift’ in business culture where the organisation’s *auditing for sustainability* should be committed to integrating environmental performance to wider issues of global ecology. There are three other auditing levels sandwiched in-between these extremes. It is also apparent that SME’s will have different priorities to larger organisations because of the differing scales of operation and therefore sustainability measures devised for one would not necessarily be appropriate for the other. SME’s may already be operating in a more participatory way, for example, and may be far more open to networking and collaborative ventures.

Environmental Auditing Techniques

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
Type of audit	Compliance auditing	Systems auditing	Environmental auditing	Ecological auditing	Auditing for sustainability
Central foci	Legislation Regulations Voluntary standards Consents and discharge permits	Level 1 plus: Environmental management systems Self-determined targets and objectives	Levels 1 & 2 plus: Direct environmental impact on: water; air; and land Health and safety Protection of employees and the community Contingency planning	Levels 1 to 3 plus: Intertemporal impact on eco-systems Life cycle assessment of products Measurement of indirect ecological impacts Recognition of need to live in harmony with nature	Levels 1 to 4 plus: Equity and equality Futurity Protection of indigenous populations Construction of a social and ethical balance sheet Holistic approach
Assessment	Static	Static	Static	Dynamic	Dynamic

Table 2.6

Source: Welford & Jones 1994

2.9.2 Environmental policy

Company environmental policy is wide-ranging and is the result of many different drivers. In the main companies have implemented environmental policies because of external drivers; for example, to gain an environmental management standard for competitive reasons. There are very few companies that have implemented an environmental policy because of internal pressures to do so and those companies who have integrated their own environmental philosophy into their business practices tend to be the 'environmental leaders' in their industry sectors. For example, Philips have developed an ecodesign manual entitled *Green Pages* which provides guidelines on how their designers can reduce the environmental impacts of their products (ENDS Report 224, 1993). The following are a few of the guidelines presented in this publication:

- Create new ways of taking products apart
- Develop long-life and upgradeable products
- Consider design implications for component sorting technology
- Design multiple life or returnable containers
- Explore alternatives to stickers such as mould inserts, laser printing and compatible plastics
- Find alternatives to solvent based lacquering such as mould texturing and water-based finishes
- Make products more recyclable with mono-materials and new electrical disconnection systems
- Redesign batteries and battery packs, and make other toxic components separable.

Dr Marzano, Senior Director of Philips Corporate Design, stated that,
'We need to abandon our obsession with adding extra function or fancy gadgets to our products. We need to replace the 'use and throwaway' mentality.' (page 22)

In the main it seems to be predominantly medium and large companies that have prepared an environmental policy. However, it should be noted that the presentation of an environmental policy does not always equate with comprehensive environmental action within the organisation. Smaller companies generally seem to operate on a more informal level where the implementation of practices as a result of policy initiatives are rare. [own research (1992-1995), see Chapter Six: 6.3.2 (a), 6.4.2, 6.4.3 & 6.6.3]

The environment has been exploited as a resource because it is perceived as 'free' to use it up or pollute it. Over the last thirty years or so, there has been an increasing awareness of governments to the limitations of this type of thinking and environmental policies at this level, have sought to limit this abuse. Governments have used a mix of both mandatory and voluntary methods to achieve environmental goals set at both a national and

international level. Hinnells and Potter (1994) describe three policy methods used by governments to achieve a wide variety of environmental targets:

1. Mandatory regulation - This is the maximum intervention approach where companies must comply. Regulation originates from a process pollution prevention perspective where environmental damage tended to be quite 'visible' (polluted rivers from factory waste pipes) and now, also addresses a product perspective: e.g., elimination of CFC's in aerosols, minimum energy standards for domestic appliances

2. Economic Instruments - These methods broadly attempt either to raise the cost of polluting, or reduce the cost of preventing pollution which subsequently influences patterns of purchasing (i.e., carbon tax, high levels of tax on petrol).

3. Informational Instruments - These initiatives relate to a minimum level of intervention by providing the consumer with environmental information on the products they buy (e.g., Ecolabels and Energy labels). Information methods have generally arisen as a result of 'green' consumerism and are generally voluntary initiatives that tend to be ineffective in influencing change in consumer buying patterns.

In the area of product development the emphasis was placed on informational instruments; on voluntary criteria and market drivers.

One such voluntary initiative that the UK Government fully supported as a member of the European Community was the development of the EC Ecolabel. The EC regulation on Ecolabels states that the intention is to,

'encourage manufacturers to design and make products which have a reduced environmental impact during their manufacture, distribution, consumption and use as well as during disposal after use and provide consumers with better information on environmental performance of products '

(Eco-Labeling, Environment Select Committee, House of Commons HC 474-1, 5
September 1991, HMSO, para.5)

2.9.3 'Green' market opportunities

'Greener Marketing is a holistic and responsible strategic management process that identifies, anticipates, satisfies and fulfils Stakeholder needs, for a reasonable reward, that does not adversely affect human or natural environmental well-being

(Charter 1992)

Charter points out that it is important to examine, through research and strategic planning, the total effect on an organisation of launching a greener product, for example, the increase in media attention on a company that proclaims to have a 'green' product'. He specifies a number of points to be clarified as part of a greener marketing strategy:

- Has the marketing plan analysed the affect of green issues on the market?
- What effect will green issues have on profitability?

- Has the company planned for possible market shrinkages that may result from changing consumer attitudes?
- Can the company modify existing products? or will new investment be required?
- Is the company developing positive links with environmental groups?
- Is the company prepared for a possible backlash from environmental pressure groups?
- Do communications strategies emphasise environmental aspects and benefits?

(page 143)

Ryan et al (1992) point out that there appear to be a number of factors which affect the market for environmentally sensitive products and the response of companies and industry sectors as whether to adopt 'systematic' (radical ecodesign) or 'incremental' (green design) change. The development of new technologies, effective design solutions and the establishment of (mass) markets will depend very much on the 'externalities' on the process such as a particular national or regional economy; the import-export balance; current growth rates; industry sector composition; GDP; accessibility of venture capital; current industry policy etc. [see Ryan et al (1992)]

Evidence points towards the significance of smaller companies in innovation (Potter 1992; Ryan 1992b) This also seems true for the development of more environmentally sensitive products where smaller companies are able to respond to the 'green' demands of the market. Potter explains this by suggesting that radical ecodesign might require major changes in current production processes. Large firms tend to have high investment and complex production systems which they cannot alter and so chose to focus on incremental environmental changes to products (green design), e.g. packaging. Smaller companies are generally not tied to complex production processes and therefore they have greater freedom and flexibility to produce innovative ecodesigns.

Roy (1994) examines the evolution of existing 'greener' designs and shows a series of stages that characterise the 'design evolution process'. These are:

- *exploration* - a variety of inventions and conceptual designs are developed
- *consolidation* - a limited range of dominant designs are established
- *maturity* - a range (or family) of standardised products is produced efficiently and diffused into society; at this stage innovation shifts from a product to a process focus with minor product improvements used to differentiate between competitors' products
- *further innovation* - within mature product markets competition intensifies and from this emerges a phase of further innovation within product families in an attempt to capture new markets
- *decline* - when a product reaches it's limit of performance (often on a technological level) it either declines or is displaced by a new product concept or technology.

Relating these stages to the evolution of ecodesigns Roy highlights a number of points:

1. There will be increasing numbers of products based on ecodesign principles on the market which will significantly reduce the current environmental impact of products.
2. Modifications or redesigns (incremental changes) to products to reduce environmental impact will have an immediate impact on the market. (Green Design)
- 3 Systematic ecodesign will occur over a much longer time period (Ecodesign
->Sustainable Design)

2.10 Conclusions

The historical overview illustrated the complex and diverse nature of ecodesign. It illustrated how design reflects societal, cultural, technical, environmental and political agendas of the time. The huge technological leaps of the twentieth century have placed society in a position of 'power' that humankind has never before witnessed; this has dramatic consequences for design as a whole. The proliferation of artefacts in the latter part of the twentieth century is of deep concern to the survival of the ecosystem. The rate of growth of population and the advancement of technology, health, wealth and security in both industrialised and developing nations alongside an 'runaway' production / consumption system does not bode well for the future of the world we see today. In other words, it is an unsustainable rate of growth under present conditions. (World Commission on Environment and Development, 1987)

The following points summarise the areas raised in the secondary research:

- Design as a key role to play in reducing 'man-made' environmental impacts through processes such as ecodesign.
- A number of ecodesign approaches and strategies have been reviewed and it is clear that the subject area is in it's early stages of evolution.
- Theories have been developed but few have been translated into practical guidelines to be included within environmental management guidelines.
- There are opportunities for studies to be made on 'the state-of -the -art' present day ecodesign philosophies and practices in industry; the opportunities and barriers for ecodesign.
- There is a need for a design perspective as opposed to a management perspective in looking at the rate of success of ecodesign strategies.

2.11 Emerging research questions

The literature review has identified a number of issues in the area of ecodesign which this research aims to address in order to develop a better understanding of the relationships between designer, design process, organisation and environment. It is hoped that a greater degree of understanding in the field of environmentally responsible design will enable the future implementation of effective ecodesign strategies within design-based industry. On the basis of this secondary research, the following preliminary questions for the primary research stages of the project have been formulated.

- What constitutes 'best practice' in environmentally responsible design in UK design-based industry
 - is there a difference between industry sectors regarding best practice?
 - does the size of company have any influence on best practice?
- What levels of environmentally responsible design are currently being practised in UK design-based industry?
 - green design? (incremental product changes)
 - ecodesign? (changes over entire lifecycle of product/process)
 - sustainable design? (major systematic changes in company design practice and practices external to the company, i.e., suppliers, customers, market, competitors,)
- To what degree are designers aware of environmental issues?
 - generally?
 - in relation to their company's practice (environmental policies etc.)
- Do designers understand the concept of environmentally responsible design?
- What are the information requirements for designers to achieve environmentally responsible design?
- What impacts do technology and market influences have on the development of more environmentally responsible designs?
- Through what mechanisms do the opportunities arise for designers to practice design in a more environmentally sensitive way?
- Do barriers exist that inhibit the practice of environmentally responsible design?
- What future do designers see for design if the proliferation of consumer products has to be reduced in order for the concept of sustainability to be a reality.

ECODESIGN

Chapter 3

A Methodological Research Framework

'Social research is not just a question of neat procedures but it is a social process whereby interaction between researcher and that which is being researched leads to the continual redefinition of the project and the methodology.'

Burgess (1984)

3.1 Introduction

The aims of this chapter are to:

- present a discussion of possible methodological approaches and justify the approaches taken within the research study
- to present an overview of the research study design.

Ecodesign is a new area where a theoretical basis is still being developed. The research is therefore of an exploratory nature, aiming to obtain opinions of designers, managers of design and environmental managers in order to gain an understanding of the barriers and opportunities behind the integration of ecological issues within design practice. This exploratory level of research will aim to contribute to a theoretical foundation concerning the inclusion of environmental criteria within design practices across a broad spectrum of manufacturing industry. The methodological approaches chosen for this study must therefore be compatible with the exploratory nature of the research.

The research study does not aim to test or explore existing theory primarily because of the lack of established theory in this area of design. Rather it is concerned with obtaining insight and an in-depth knowledge of this new subject area through the literature review and the pilot and main studies.

An overview of the research design is shown in Figure 3.1. It illustrates the connections between research elements in the background research stage and those of the main research study; these are discussed in greater detail later in the chapter.

Overview of Research Design

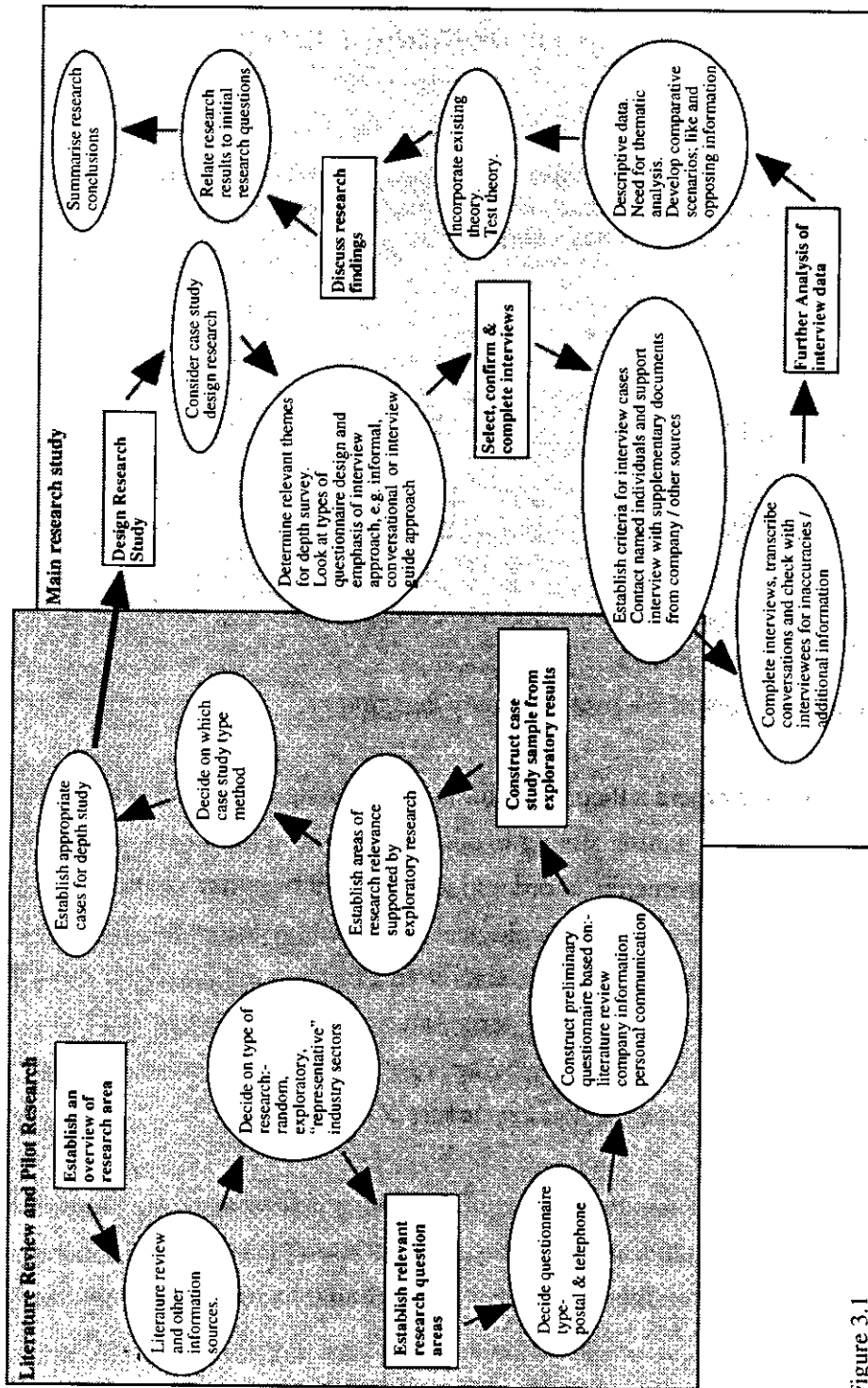


Figure 3.1

3.2 Methodological framework

In researching such a new and expanding subject area it would be problematic to adopt a methodology that was too restrictive and structured or one that lacked explanatory power. It was felt important that the research approach should be able to evolve as the research developed and therefore an inductive research approach was preferred to a more deductive research perspective. As Strauss and Corbin (1990) point out,

'... data collection, analysis and theory stand in a reciprocal relationship with each other. One does not begin with a theory then prove it. Rather one begins with an area of study and what is relevant to the area is allowed to emerge.'
(page 23)

Initial research was undertaken using secondary sources such as published literature, company literature, discussions with other researchers and general media sources. This overview formed the basis for preliminary questioning of designers and managers within the initial background research study.

The purpose of the initial study was to:-

1. gain a general overview of awareness and action regarding the inclusion of environmental criteria within the design process across a range of industry sectors and design disciplines,
2. highlight possible companies for further, more in-depth research via case studies,
3. ascertain the main areas of investigation for the more intensive, in-depth study,
4. identify methods of investigation appropriate for the in-depth study

The pilot study covered a wide range of design consultancies and companies from three industry sectors. All companies were selected randomly in order that some general conclusions could be drawn. This initial insight into current activity on environmentally responsible design in the UK produced an indication as to how 'advanced' environmental thinking was within design-based companies. Detailed information on what was happening in these companies or what designers thought about these changes or lack of changes, was not the main concern of this initial study. In fact a simple understanding of the subject area and a direction on which to focus the more intensive study was the key information required from the initial investigations. In order to obtain this type of information a structured approach to the research was required, and so, for the background research, a more *quantitative* and *extensive* research method was adopted.

The pilot and the main studies used different methodological approaches; the first, as noted above, is a more quantitative and structured approach and the main study, a more qualitative, semi-structured and explanatory research approach. The use of both qualitative and quantitative research methods is known as a multi-method research approach (Burgess 1984). A summary of these two research approaches is illustrated in Table 3.1.

	Qualitative	Quantitative
Research Question	How does a process work in a particular case(s)? What produces a certain change? What do the agents actually do?	What are the regularities, common patterns, distinguishing features of a population? How widely are certain characteristics or processes distributed or represented?
Relations	Substantial relations of connection.	Formal relations of similarity.
Type of groups studied	Casual groups.	Taxonomic groups.
Type of account produced	Casual explanation of the production of certain objects or events, though not necessarily a representative one.	Descriptive 'representative' generalisations, lacking in explanatory information.
Typical methods	Study of individual agents in their casual contexts, interactive interviews, ethnography. Qualitative analysis.	Large scale survey of population or representative sample, formal questionnaires, standardised interviews. Statistical analysis.
Are the results generalizable?	Actual concrete patterns and contingent relations are unlikely to be 'representative', 'average' or generalizable. Necessary relations discovered will exist wherever their relations are present, e.g. casual powers of objects generalizable to other contexts as they are necessary features of these objects.	Although representative of a whole population, they are unlikely to be generalizable to other populations at different times and places. Problem of ecological fallacy in making inferences about individuals.
Disadvantages	Problem of representativeness.	Lack of explanatory power. Ecological fallacy in making inferences about individuals.

Table 3.1.

This table illustrates the main differences between an qualitative research approach and an quantitative research approach. The former generally evolves from a unstructured set of questions or themes on the topic being investigated. There is little detail or connection on which to build a direct research survey and the researcher must allow the individual agents in their natural contexts to evolve the research study; this process is iterative in nature and although not geared to developing representative and generalizable research findings it does form the basis for studying relationships and building new research theory, thus encouraging further qualitative and quantitative research in the area under investigation.

Alternatively but not exclusively, the more extensive research approach is based upon known characteristics of the individual or subject under investigation. There is usually a basic understanding of the research area and the quantitative approach utilises this initial knowledge to ascertain a wider understanding of the area through structured research approaches. For example large scale surveys in the form of formal structured questionnaires are a common method to achieving representative results; these are usually analysed statistically. This approach tends to make broad, generalizable statements but lacks explanatory detail.

Within social research there are tensions between research modelled on the practices of natural science and ideas about distinctiveness of the social world and the implications of this and how it should be studied (Hammersley 1983). This tension is often presented as a choice between two conflicting paradigms [Johnson (1976), Schwartz and Jacobs (1979)] and whilst the names of these paradigms often differ there is considerable overlap in the content among the various accounts. Hammersley (1983) suggests that these paradigms be called 'naturalism' and 'positivism'. A positivistic focus favours a quantitative research approach whereas the naturalistic paradigm promotes a qualitative approach such as ethnography.

Although both research approaches represent different processes and have different procedures, they are complementary to each other. Qualitative research and quantitative research can view a subject from different perspectives and hence the sources of information obtained allow a more holistic view of the subject under investigation.

Qualitative = soft, subjective and speculative

Quantitative = hard, objective and rigorous (Halfpenny 1979)

Researchers have concluded that these two research perspectives should not be perceived as being mutually exclusive; rather the strengths and weaknesses of different approaches may be used together resulting in a multi-method research design within and between the two paradigms. [(Zelditch (1962), Sieber (1973)]. It is important that qualitative and quantitative data are not thought of as opposites. The main question is one regarding the varying degree to which a structure exists to analyse data and the researcher's awareness of that structure. Hammersley (1994) summarises this as:-

- being aware of the methodological consequences of using particular techniques
- being aware of the practical consequences of using particular techniques.

Newbury et. al., (1996), point out that the debate regarding the use of qualitative or quantitative research approaches highlights the limitations associated with relying on any singular view of a research area. They go on to say that research should not be concerned with the application of predetermined methods, but moreover be concerned with the

development of the methodology itself. In particular the area of design research should encourage open and creative approaches to research methodology. Langrish (1993) also addresses this concept in relation to case studies in design; he emphasises that creativity and openness are absolutely crucial in relation to design cases where without 'freedom', design becomes an illusion.

3.3 Survey methods

A survey involves gathering information from a sample of individuals. Traditionally surveys are seen to embody research that is representative, that is generalizable, that favours a quantitative approach. It has been argued, (Hammersley 1993), that qualitative case studies can be viewed as part of a survey approach; this debate encourages the researcher to view a more qualitative approach as being compatible with generalizable research findings. In this sense, qualitative research can add to the more 'general picture' and is not limited to producing non-generalizable results.

More commonly, a survey involves the use of a structured questionnaire with answers open or closed where responses can be easily compared and contrasted. (Coolican 1990)

The survey approach may be used for two major research purposes: descriptive or analytical, where the former, more qualitative approach, tends to be more subjective and thus harder to verify.

- The descriptive approach- used where an accurate description of what people, in some target population, do and think and with what frequency, is generally related to a study of attitude and behaviour.
- The analytical approach - this type of survey data is generally used to test hypotheses.

In survey work there are three main areas of decision-making necessary before initiating the contact with respondents. These are the sample, the mode of questioning and the questions (Coolican 1990).

The pilot study was based upon two survey methods; a postal survey and telephone survey. Both of these were structured and were based on secondary information on the subject under investigation. Secondary information was obtained from a comprehensive literature review, environmentally high-profile company reports, discussions with other researchers in similar areas of research and informal discussions with design personnel in industry. This secondary information highlighted a number of areas for further questioning; questionnaires for both a postal and telephone survey were developed from this information. The rationale for choosing postal and telephone survey approaches was justified by the need for a relative large number of companies to be contacted in order to obtain a realistic overview of current

UK design attitudes to integrating environmental responsible criteria within product development. Structured surveys at this level were adequate as the questions were not of the form that needed face-to-face validation.

The results of the background research produced the guidelines for the design of more in-depth questionnaires for the main research study; this involved a survey of twenty case studies of UK design consultancies and design-based industry.

3.4 Case study method

The main research study focused on a case study methodology.

A case study research method is generally used when the investigator has little control over events and when the focus is on a contemporary phenomenon within some real-life context. Case studies are the preferred strategy when 'how' and 'why' questions are being posed and often relate to an analytical case study although exploratory and descriptive case studies can also be used, either singularly or to complement one another.

Yin (1989) defines the case study as,

'an empirical inquiry that investigates a contemporary phenomenon within it's real-life context when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used.'

and Schramm (1971) describes the case study as,

'the essence of a case study, the central tendency among all types of case study, is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented and with what result.'

Case studies can include evidence of both a qualitative and quantitative nature. (Yin 1989)
The strength of the case study method is it's inherent ability to deal with a wide variety of data sources including documentation, personal interviews and observation.

3.4.1 Research aims of case study method

Case studies can provide a deeper understanding and a fuller contextual sense of the subject under investigation, and a foundation for the development of theory. [Miles & Huberman (1984), Van Maanen et al (1982)].

Langrish (1993), examining case study methodology from a design perspective, makes the point that good case studies must aim to attack the question of the extent to which the future is planned as opposed to just happening. He specifies three main research aims for the case study method:-

1. To develop labels for use in a classification scheme (taxonomy)
2. To look for principles underlying the taxonomy
3. To understand movement through time

3.4.2 Case study designs

Langrish looks at a 'biological' or evolutionary approach to case study design. He describes six basic types of case study selection:-

the comparative - derived from agricultural research, people seem to like the sense of structure obtained from comparing, say, small, medium and large firms in 2 industries.

the representative - this approach has vague notions of a statistically valid sample.

the best practice - if it is an aim to improve practice then it is a good idea to look at 'the best' - but what does 'best' mean/ ... prize winners, expert views ...

the ones next door - sample restricted for practical reasons.

the 'cor, look at that' - Obtained from picking unusual examples - the representative can be boring, the unusual can offer surprise and perhaps challenge the conventional wisdom.

the taxonomic - cases are examples - a taxonomy that dictates the selection of further cases.

The main research study aimed to look at companies that had 'best' ecodesign practice. However, as a result of the exploratory research results, the emphasis was altered to look at companies with 'better' ecodesign practice. This change in sample criteria is discussed in Chapter 5.

3.4.3 Multiple verses single case studies

Yin (1989) illustrates the different types of case study by using a matrix. This is based on the assumption that single- and multiple- case studies reflect different design considerations and that within these two types there also can be unitary or multiple units of analysis.

Table 3.2 shows the case study matrix as described by Yin (1989)

	single-case design	multiple-case design
Holistic ~ <i>single unit of analysis</i>	Type 1 Single-case (holistic)	Type 3 Multiple-case (holistic)
Embedded ~ <i>multiple units of analysis</i>	Type 2 Single-case (embedded)	Type 4 Multiple case (embedded)

Table 3.2

3.4.3 (a) Rationale for single-case design

Single-case design can be justified in certain conditions. These are:-

- The case is the critical case - it can be used as the critical test of a significant theory.
- The case represents an extreme or unique situation.
- It is a revelatory case; the investigator has the opportunity to observe and analyse phenomenon previously inaccessible to scientific investigation.

The primary drawback of single-case studies is the vulnerability of focusing completely on the one case where the case under investigation is not the case it was originally thought to be. To avoid such problems it is imperative that the researcher should complete an initial thorough investigation to minimise the chances of misrepresentation.

Both single-case design types, holistic and embedded, focus on a critical, unique or revelatory cases. The holistic perspective takes a global approach to the investigation whereas the embedded type moves between the overview level of the larger unit to individual units where a greater understanding of detail and connection can be found. Table 3.3 describes these two single case types and illustrates the benefits and drawbacks of both.

	Holistic	Embedded
<i>Description</i>	researcher considers overview of subject - a global view.	analysis of individual units within larger unit of analysis.
<i>Benefits</i>	gains a comprehensive insight of the operational whole	provides detailed information; an ability to focus on relevant elements.
<i>Drawbacks</i>	avoids examining any specific phenomenon in operational detail	focuses on one sub-unit level while failing to return to larger unit of analysis

source: Yin (1989)

Table 3.3

The over-riding concern with single based case studies is the problem associated with misrepresentation and a shifting emphasis of study. This shift describes the situation where

the initial questioning focus is no longer relevant in light of evidence produced during the study.

The advantage of this shift is the inherent flexibility of this approach. The disadvantage is one of the research design no longer being relevant to the research questions being asked, (Yin, Bateman & Moore, 1983).

3.4.3 (b) Multiple-case design

The advantage of using a multiple-case design approach over that of the single-case design is that the evidence produced from multiple cases tends to be more compelling and thus the overall study is generally considered to be more robust. However multiple studies often require extensive resources and greater amounts of time to successfully complete. Yin (1989) points out that

'every case should serve a specific purpose within the overall scope of inquiry. Here, a major insight is to consider multiple cases as one would consider multiple experiments - that is, to follow a 'replication' logic. This is far different from a mistaken analogy in the past which incorrectly considered multiple cases to be similar to the multiple respondents in a survey (or to the multiple subjects within an experiment) - that is, to follow a 'sampling' logic.'

Replication in multiple studies considers each case to be akin to a single experiment - the analysis must follow cross-experiment rather than within-experiment. Each study is selected to either

- a) predict similar results (a literal replication) or
- b) produce contrary results but for predictable reasons (a theoretical approach).

Common to all replication procedures is the development of a detailed theoretical framework. The framework needs to state the conditions under which a particular phenomenon is likely to be found (a literal replication) as well as conditions when it is not likely to be found (a theoretical replication). The framework can emerge as a vehicle for making generalisations to new cases. (Yin 1989)

3.4.4 Gaining access to 'site' for data collection

Gaining access to a company, organisation or individual can prove to be one of the most difficult aspects of the case study approach. Access is not a straight forward procedure and different approaches often must be made to a wide variety of individuals at different levels of the organisation. Thus, *access involves negotiation and re negotiation.* (Burgess 1984)
The level or degree of access the investigator has influences the type of investigation and the position which s/he can take in collecting the case evidence.

Access influences not only the reliability and validity of the data, but the point of contact within an organisation will influence the collection of the data and perspective portrayed, while activities during the access stage will influence the ways in which those being researched define the research and the activities of the researcher. (Burgess 1984)

One of the primary concerns regarding access is a result of the fact that the researcher might not fully understand the research problem and the access required as the research unfolds; the researcher's conception of the project is continually being modified and in this respect the researcher is not just concerned with research design and research access at the beginning of a project, but throughout the research process.

3.4.5 Sources of evidence for case study

Generally a number of different information sources are used to develop a case study. Yin describes these sources in six categories:-

- 1. Documentation** communication - e.g. letters and memos
written reports, agendas
internal documents such as proposals and progress reports
information from other studies of the same site under investigation
information from mass media sources
- 2. Archival** Records - service (client base) and organisational (budgets etc.)
Geographical information such as maps and charts
Lists of relevant commodities
Survey data - information previously collected about a 'site'
Personal records - diaries, telephone conversations etc.
- 3. Interviews** an open-ended interview ('unstructured')
a focused interview ('semi-structured'/'structured')
a formal survey ('structured')
- 4. Direct Observation** passive observation, ranging from formal to casual
- 5. Participant Observation** investigator assumes active observation
- 6. Physical artefact** for example, an eco-redesigned product

Table 3.4 presents an overview of the various interview types; their characteristics, strengths and weaknesses.

The major strength of the case study is the opportunity to use multiple sources of evidence thus enriching the nature of the study and the scope of perspective obtained. Multiple sources help establish the construct validity and reliability of a case study.

Types of interview (after Patton's *Qualitative evaluation methods*)

Table 3.4

Type of interview	Characteristics	Strengths	Weaknesses
1. Informal, conversational interview	Questions emerge from the immediate context and are asked in the natural course of things: there is no predetermination of question topics or wording.	Increases the salience and relevance of questions: interviews are built on and emerge from observations: the interview can be matched to individuals and circumstances.	Different information collected from different questions. Less systematic and comprehensive if certain questions don't arise "naturally". Data organisation and analysis can be quite difficult.
2. Interview guide approach	Topics and issues to be covered are specified in advance, in outline form: the interviewer decides sequence and working of questions in the course of the interview.	The outline increases the comprehensiveness of the data and makes data collection somewhat systematic for each respondent. Logical gaps in data can be anticipated and closed. Interviews remain fairly conversational and situational.	Important and salient topics may be inadvertently omitted. Interviewer flexibility in sequencing and wording questions can result in substantially different respondents, thus reducing the comparability of responses.
3. Standardised open-ended interview	The exact wording and sequence of questions are determined in advance. All interviewees are asked the same basic questions in the same order.	Respondents answer the same questions, thus increasing the comparability of responses; data are complete for each person on the topics addressed in the interview. Reduces interviewer effects and bias when several interviewers are used. Permits decision makers to see and review the instrumentation used in evaluation. Facilitates organisation and analysis of the data.	Little flexibility in relating the interviewer to particular individuals and circumstances; standardised wording of questions may constrain and limit naturalness and relevance of questions and answers.
4. Closed quantitative interviews	Questions and response categories are determined in advance. Responses are fixed; respondent chooses from among these fixed responses.	Data analysis is simple: responses can be directly compared and easily aggregated: many questions can be asked in a short time.	Respondents must fit their experience and feelings into the researcher's categories; may be perceived as impersonal, irrelevant, and mechanistic. Can distort what respondents really mean or experienced by so completely limiting their response choices.

3.4.6 Analysing case study evidence

Yin (1989), specifies two types of analytical strategy:-

1. *Relying on theoretical propositions.* This is the preferred strategy where the original objectives and design of the case study were based on theoretical propositions which in turn reflect a set of research questions, reviews of the literature and new insights. The theoretical perspective helps sift out relevant data throughout the research study and also helps to organise the case study and define alternative explanations to be examined.
2. *Developing a case description.* The strategy here is to develop a descriptive framework for organising the case study. The descriptive approach in Yin's opinion is less preferable than a theoretical strategy but is considered to be a good alternative where theoretical propositions are absent. The descriptive approach may help to determine and identify appropriate casual links to be analysed - for example, in a complex and involved study a descriptive insight may well identify the process of decision making and lend a greater 'explanatory' element to the overall case study.

Glaser and Strauss (1967) define *theoretical sampling* or *grounded theory* as,

'the process of data collection for generating theory whereby the analyst jointly collects, codes and analyses his data and decides what data to collect next and where to find them, in order to develop his theory as it emerges.'

Smith and Poland (1976) consider the theoretical sampling approach to be one of *'the most significant contributions to field research.'*

There are a number of concepts associated with theoretical sampling including 'saturation' and slices of data'

saturation: refers to the fact that no additional data can be found that contribute to the categories being considered. The researcher must focus on 'situations' until no further insights can be generated.

slices of data: defines different kinds of data that give the analyst different views or vantage points from which to understand a category and to develop it's properties. It has much in common with the multi-method research strategy.

This model of generating theories gives rise to either

- **substantive grounded theory**
- **formal abstract theory**

These can be distinguished as:-

'by substantive theory, we mean that developed for a substantive or empirical area of sociological enquiry, such as patient care, race relations, professional education, delinquency or research organisations. By formal theory, we mean that developed for a formal, or conceptual area of sociological enquiry, such as stigma, deviant behaviour, formal organisation, socialisation, status congruency, authority and power, reward systems, or social mobility. Both types of theory may be considered as 'middle range'. That is they fall between the minor working hypotheses of everyday life and the 'all inclusive' grand theories!'
(Glaser and Strauss 1967)

In contrast to analytical induction, grounded theory is a comparative method concerned with generating and developing categories, properties and hypotheses *rather than testing* them.(Strauss & Corbin 1990)

Burgess (1984) describes four stages of this method.

- | | |
|----------------|---|
| Stage 1 | compare incidents applicable to each category (data coded) |
| Stage 2 | integrate categories and their properties |
| Stage 3 | theory is delimited: reduce theory and delimit the saturation of categories (ensure that criteria used to select and delimit categories is checked) |
| Stage 4 | a writing period: analytical memo's are produced which will provide major themes for further publications |

This procedure is also described in Figure 3.2. It is *an iterative process* of identifying, evaluating and linking themes within the research study so that these 'themes' connect and there is an overall rationale, an overall argument to the research.

Grounded Theory Procedure

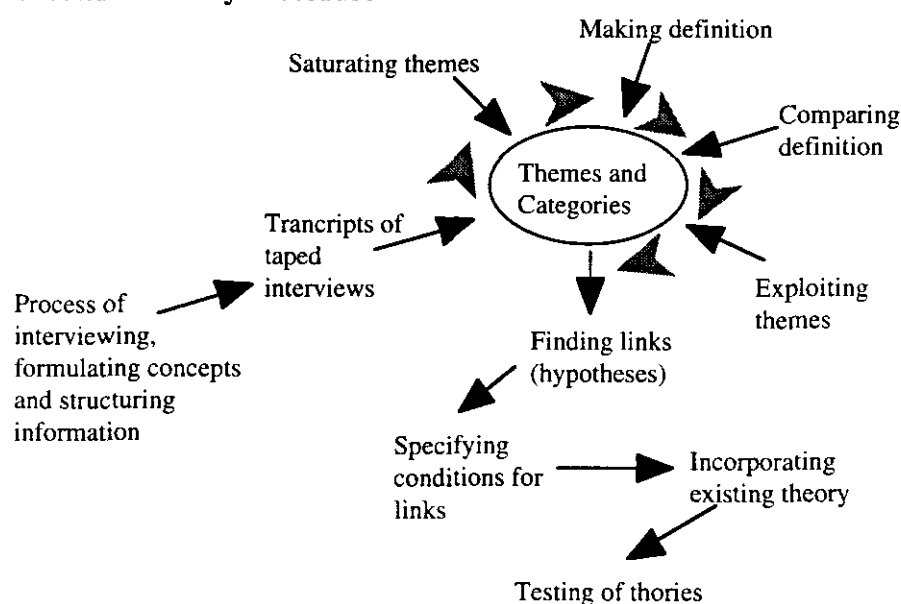


Figure 3.2

Adapted from Turner's (1981) description of the Grounded Theory process found in *In Search of Dialogue: Vegetation Management in Western NSW, Australia*, PhD thesis by Stephany Kersten (1995)

3.4.7 A critical appraisal of the case study strategy

Case studies have been viewed by some researchers as a poor substitute for both experimental and survey approaches.

The main criticisms of the case study approach are:-

1. The lack of 'rigour' associated with this approach, e.g. the researcher allows equivocal evidence or biased views to influence the direction of the findings and conclusions (Coolican 1990)
2. Case studies provide little basis for scientific generalisation
3. They require too much time to complete and result in massive, unreadable documents. (Yin 1989, Burgess 1984)

The following comments attempt to address the above points in support of a case study approach.

Supporting a case study strategy

1. It is the investigator's responsibility to ensure that bias within the study is eliminated or at least minimised. However, bias is not solely the domain of the case study; it is extremely hard to eliminate bias from other research methods such as experiments and questionnaire design for survey methods. Bias is a common problem to all research methods (Sudman and Bradburn 1982)
2. A single case study is similar to a single experiment; scientific generalisation is very rarely based on a single experiment, rather it is based on a multiple-experiment approach where replication is the key factor.

'Case studies like experiments, are generalizable to theoretical propositions and not to populations ... the case study, like the experiment, does not represent a "sample", and the investigator's goal is to expand and generalise theories and not enumerate frequencies.'

(Yin 1989)

3. Case studies are confused with other methods of data collection that may be more time intensive, for example, ethnography and participant-observation methods. Case studies are a form of inquiry that do not depend solely on these more time intensive, research methods.

The case study method is most usefully utilised when the subject under investigation is complex, when existing knowledge of the phenomenon is scarce, and when the nature of the research requires the phenomenon under investigation to be studied in a natural context.

The case study has the potential to generate rich, contextual information, broadening research perspectives and introducing new areas for further research study. (Burgess 1984, Yin 1989 & Hammersley 1983, 1994)

3.5 The research design

3.5.1 Introduction

For this project, the research design aims to obtain an in-depth understanding of the attitudes and actions of UK companies concerning the integration of environmental criteria within design processes. It also aims to provide an understanding of design processes across a broad range of industries and to draw conclusions as to how environmental criteria can be successfully integrated to produce more environmentally responsible designs. This is a new area of design research; it is both broad and complex in nature and thus the research methodology chosen must satisfy a number of requirements,

- be flexible;
- allow investigation at a number of levels;
- produce descriptive information;
- produce results which enrich understanding of phenomenon.

Background research in this area initially looked at secondary sources of information. The aim at this initial stage of the research study was to ascertain current industrial awareness of 'ecodesign' and gain a greater understanding of initiatives in this area. The following sources were investigated:-

- a literature review - a wide subject area including design, management and environmental issues
- company documents - e.g. environmental reports, articles, advertisements
- mass media information such as newspaper clippings
- seminar and conference proceedings
- personal communication - with other researchers and companies
- environmental award schemes such as the Queen's Award for Environmental Achievement and Eco-Labelling initiatives.

At this stage of the research there were informal as opposed to formal hypotheses that were refined and tested. These were represented by a set of questions which are referred to in Chapter Two, p55. This approach is supported by other researchers (Burgess 1984 and Dalton 1959) who have proposed the following reasons in support of not formalising any initial hypotheses:-

- The researcher may not feel sure of what is relevant for hypothesising until s/he has some intimacy with the situation - The hypothesis is thought of as a well-founded conjecture.
- Once uttered, a hypothesis becomes obligatory to a degree.
- There is a danger that the hypothesis will become esteemed for itself and work as an absurd symbol of science. (Dalton 1959)

The pilot study, as part of the background research, focused on design personnel in design consultancies and in design-based industry in the UK. All respondents were chosen randomly so as to obtain a general overview of attitudes and action towards a more environmentally responsible design practice. It was also an aim of the exploratory research to find suitable 'proactive' companies to interview in greater depth.

The main research study focused on companies that had an interest in environmental issues and which had, in most cases, initiated environmental design action. This study consisted of twenty interviews with key design personnel and in some cases environmental management personnel, the duration of these interviews being between one hour and four hours.

Throughout the main research there was a continual appraisal of the results, a continuous analysis of the feedback, and an evolution of the interview questions. Although this may cause problems in comparisons of results from different interviews, the evaluation of the interview schedule is inevitable in this type of semi-structured interview approach where the investigator's knowledge of the subject area grows with increased interaction with those involved with the practice of the subject. Despite the problems of analysis it would be a mistake to ignore this increased knowledge and try and prevent the evolution of questioning.

A visual representation of the research design can be seen in Figure 3.3. This diagram illustrates the progress of the research project from the initial clarification of the subject area to the conclusions formed from the research results. As can be seen there are two distinct stages of the research project; the first is the **general stage** where the researcher is concerned with defining the research problem and placing the research in some form of perspective. The second stage is the **specific stage** and demonstrates the researcher's ability to focus and refine the continuous stream of research results into research conclusions which relate to the formalised research questions. Throughout the research project there is a dramatic increase in the general knowledge level of the researcher in her chosen research area. This background information benefits the contextualization of the research phenomenon and gives an overall perspective to the research project. Figure 3.3 should be used in conjunction with the following description of the stages of this research project.

Focusing the research project

GENERAL:
defining problems and perspective

SPECIFIC:
focusing and refinement

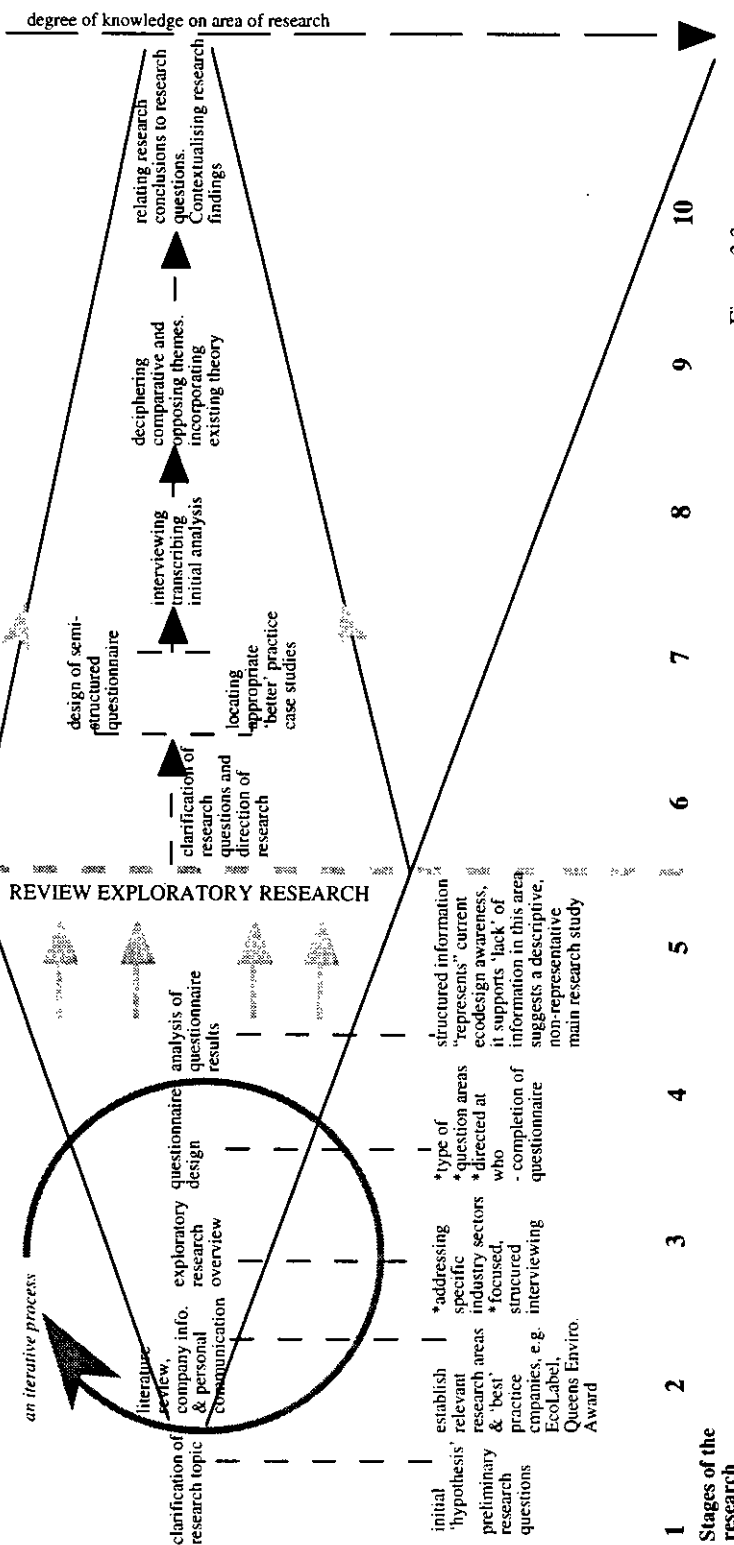


Figure 3.3

3.5.2 Background research

The background research consists of a literature review and a review of other secondary documentation; a pilot study of design consultancies and design-based industry. These are described in the following sections.

3.5.3 Secondary information sources

The initial investigation of documentary evidence, literature, company reports and other documents, newspaper and journal articles and personal communication with other researchers in similar research areas led to developing an understanding of ecodesign within a business management and environmental context.

This information produced a starting point developing questions for the exploratory research although the questions and themes for the research were iteratively refined as the project developed (Figure 3.3, stage 1).

In parallel to the literature and document reviews, the secondary research stage also provided an opportunity for identifying companies that had received an environmental award or which had received publicity for environmental design or environmental management (Figure 3.3, stage 2). Two such schemes initially used were the Eco-labelling award scheme and the Queen's Award for Environmental Achievement. It was thought that companies applying for these schemes would be at the top of the scale regarding environmental action and therefore would make exemplary cases for the main research study. Unfortunately this was not found to be the case due to the fact that:

- The eco-labelling scheme was in it's embryonic stage and was taking longer than predicted to establish itself at the company level. There were no appropriate companies at this stage but it was thought that white goods industries might be a realistic group to focus on in the exploratory research as the impact of the ecolabel and other energy labelling schemes might well be filtering through to the market place;
- There were still some months to wait before a shortlist for the Queen's Award for Environmental Achievement would be available for general release; this was not compatible with the time restrictions of the research programme as the completion of the pilot study within the first year was essential in order that appropriate companies could be chosen for the main research study.

3.6 Pilot study

Aims

The general aims of the pilot research study were to:

- gain a general overview of design awareness and action regarding the inclusion of environmental criteria within design and development processes;
- highlight possible companies for the main, in-depth research study.

(Figure 3.3, stages 3 & 4)

The questions that were asked in the pilot study were divided into three areas:

General company information

Information on designers and design practice

Information concerning environmental attitudes and initiatives.

The questions were kept short and simple, many requiring a yes/no response. Some questions required respondents to rank their responses and some required a one or two sentence explanation. The primary aim of focusing on clear, 'uncluttered' questions was to achieve a good response rate; it was felt that respondents would be more likely to complete and return a quick and relatively straight forward questionnaire than one which required the respondents to continually explain and justify responses, taking a long time to complete. This survey did not aim to be representative of any industrial sector, but to present a general picture of industrial attitudes to change within present design and development and management practices. The basic rationale behind the survey was to question designers from both design consultancies and companies in order to obtain design perspectives from these two different situations.

3.6.1 Selection of companies for pilot study

3.6.1 (a) Postal surveys

In the design consultancy industry it was thought that a general overview of several design disciplines would produce an accurate picture of the different environmental factors impacting on all design areas. Design consultancies were randomly selected from the Design Council list of UK based design consultancies in order to obtain a representative picture of UK design consultants' attitudes. The design areas covered included:-

- product
- graphic and packaging [3D]
- architecture
- interior

There was however an emphasis placed upon product design and graphic design as it was thought that these two design areas were likely to experience a greater degree of pressure to be environmentally aware than other design areas. For example, product design consultancies are involved with a variety of projects and therefore would be exposed to a wide range of environmental pressures from clients / legislation / marketplace. Packaging is a 'high profile' environmental area where demands to consider the environment as part of design practice were likely to be considerably higher than in say, fashion design.

Quite separate to this research project, UMIST members of DIG were developing a questionnaire to address all design consultancies on the Design Council's list of UK design consultancies as part of a larger study on design consultancies. The opportunity was taken to include a question asking whether consultancies had integrated an environmental policy or environmental thinking within their business practices. This questionnaire was sent to over 600 design consultancies country-wide. Positive responses to this question were followed up as part of the next stage of the research design.

3.6.1 (b) Telephone survey

For the telephone survey companies were randomly selected from the Kompass Directory in three industry sectors affected by high-profile environmental issues :-

- the white goods industry affected by energy and resource issues
- the packaging industry affected by disposal issues
- the furniture industry affected by resource issues.

Thus, the main aim of the telephone survey was to cover firms facing a range of environmental issues. The maturity and complexity of environmental issues differs between the industry sectors chosen. It was thought that this would result in finding a wide range of business initiatives regarding environmental responsible design within these three industry sectors.

3.6.2 Pilot survey design

(Figure 3.3, stage 4 & 5)

3.6.2 (a) Postal survey

This type of survey was applied to the design consultancy industry and focused on design managers within consultancies; note that design managers in design consultancies are often practising designers and are therefore very familiar with the design process, design problems and design terminology.

The questionnaire was designed to try to eliminate 'surface' responses. It must be acknowledged that this is extremely hard to achieve, as respondents will complete a questionnaire to satisfy their own perceived image of the company and it may or may not be representative of their company practice. This was acknowledged when analysing the responses. For example, respondents may specify that their company had an environmental policy and then later describe it's aims as 'an awareness of environmental issues'. This clearly is not a formal policy and it is an area of questioning that was altered in subsequent questionnaires to clearly state whether a formal or informal environmental policy existed - this distinction was not made in the initial surveys.

The postal questionnaire survey produced a 50% response from the design consultancies sampled; this is a relatively large response and reflect the straightforward design and short length of the questionnaire.

The postal, design consultancy questionnaire is reproduced in Appendix 1A.

3.6.2 (b) Telephone survey

The questionnaire focused on similar areas as the design postal questionnaire. This survey method was chosen because of the large number of companies being contacted [a total of 116 in all]. It was thought that the more direct telephone approach might encourage a higher response than a postal survey. In fact, the response was similar for both survey types. In most cases design and technical personnel were contacted although other personnel did respond; for example personnel in PR departments, health and safety officers and in a few of the smaller companies, managing directors.

The telephone questionnaire is reproduced in Appendix 1B

Both types of survey used a closed, quantitative method. In this way responses could be directly compared and easily aggregated and a number of areas could be covered in a short period of time. The weakness of this approach is that the respondents must fit their responses into the researcher's perceived response categories. These may or may not be directly relevant to the respondents experience and feelings, thus this approach can led to distorted view of what the respondents really mean or experience.

Although these points criticising the method are relevant, it was seen as being the most appropriate research method for obtaining a wide range of information within a short time in order that themes for further research could emerge from the pilot study. It was also felt that this level of questioning would be sufficient to highlight appropriate future case studies for the main research study.

3.7 Main research study

Aims

- To establish what is ‘best practice’ environmentally responsible design and how this has been integrated within design and development.
- To draw on examples found in companies through the exploratory research and through other companies that may have been highlighted; e.g. through the media, through environmental awards / standards, through PR events.
- To undertake case studies in a number of these companies concentrating on environmental issues within the design process and the dynamics between the design team and other groups involved in design and development.
- To effectively integrate with the design team through participant observation techniques

3.7.1 Selection of companies and design consultancies

Referring back to Figure 3.3 it can be seen that the intensive study is based on the findings of the more extensive, pilot study. A review of these initial findings enabled a clarification of the research questions and a re-direction of the research study.

The first part of the intensive research was to establish a sound set of question themes (Figure 3.3, stage 6) and to locate appropriate cases for a more in-depth study (Figure 3.3, stage 7). Some of these companies were identified as a result of the pilot study. Positive responses from design consultancies to both the structured questionnaire and the environmental policy question on the UMIST survey questionnaire were followed up to locate ‘best’ practice design consultancies. Very few candidates for further study emerged from the responses to the telephone questionnaire.

As a result of the pilot research findings changes in the research design approach were required. This primarily concerned the location of appropriate companies from the industry sample where the white goods, packaging and furniture proved unsuccessful in supplying appropriate in-depth cases. As a result of this the decision was made to widen the manufacturing industry sample base to include any type of company providing it was UK based, had a design interest and was preferably a manufacturer. Companies were found through other channels such as applicants to the British Standard on Environmental Management (BS 7750), or companies highlighted by the press for their excellent environmental credentials.

Chapter Five reviews changes in the research design and sets the context for the main research study.

3.7.2 Semi-structured questionnaire design and interview strategies

(Figure 3.3, stages 7 & 8)

An interview guide approach was adopted for the in-depth interviews (see Table 3.4). Although a questionnaire was developed for these interviews it was used more as guidance for discussing a series of topics and issues. In this way it was thought that the interview would be seen more as a 'discussion' and in some cases, a 'conversation' with a greater degree of informality and fluidity than expected from a structured, or even semi-structured, interview design. The main benefit of this approach is to retrieve information that might be 'hidden' unless the interviewee is allowed to control to some degree the level of his/her response. Comparisons between interviews would still be possible as the sequence of topics being addressed followed a similar pattern for nearly all interviews - the exception being when certain question topics were not particularly relevant to the respondent - these were then either briefly asked or omitted altogether.

The interviews were tape-recorded unless circumstances prevented this. From this a detailed transcript was produced and returned to the interviewee for checking. This was an important part of the validation process and resulted in additional and useful information.

3.7.3 Analysis of in-depth interviews

Through transcribing interviews themes from the research study begin to emerge (Figure 3.3, stages 8 & 9). Written evidence helps place these themes in some sort of order and naturally encourages the investigator to decipher similar and opposing themes, comparing and contrasting the individual cases. As Hammersley (1993, 1994) points out,

'analysis is about identifying items which you feel you can justify. It is important that themes' within the thesis connect - that there is an overall rationale and argument.'

A grounded theory approach could address the formulation of 'middle level' theory, this procedure is illustrated in Figure 3.2. By exploiting the themes in the data and subsequently finding the connections or hypotheses, it is then possible to look at the research results in the context of existing theory. New theories and/or descriptions can evolve to support future opportunities for further research on this phenomenon or associated phenomenon.

The analysis of the main research findings in the form of a 'footprint' methodology is discussed and developed in Chapter Six - the themes that emerge from the main research are given a ranking and are 'mapped' onto a template; this results in a visual representation of a company's environmental attitude and action concerning design and management.

Relating research conclusions to the research questions and overall field of study is the conclusive stage of the research design process (Figure 3.3, stage 10).

ECODSIGN

Chapter 4

Pilot Studies: attitudes of UK design consultancies and three sectors of design based industry

4.1 Introduction

The aim of this chapter is to present the exploratory research findings of the design consultancy postal survey and the manufacturing industry telephone survey. As discussed in chapter 3, the questionnaire design focused on the main areas of design activity and environmental awareness. Both these studies highlight companies who have introduced an environmental perspective within their design and development programmes. Such companies are to be further studied by means of in-depth interviews which will aim to satisfy the main research questions.

This chapter describes the findings of the design consultancy and design-based industry pilot surveys; the latter focused on the following three areas of industry:

- white goods
- packaging
- furniture

The reasons for choosing these areas of manufacturing industry were fully explained in Chapter Three.

In conclusion both sets of results are brought together to present the overall findings of the pilot research. In so doing we see the justification for slightly revising the methodology originally suggested in Chapter Three. This change in focus is justified in greater depth in Chapter Five.

4.2 The UK design consultancy pilot survey

4.2.1 Aims

The main aim of the design consultancy pilot survey is to obtain information upon the state-of-the-art on environment issues, within UK design consultancies. The survey focuses mainly on the following points:-

- How have environmental issues affected the design industry in Britain?

- How environmentally benign are design practices?
- To what extent do designers acknowledge environmental factors when they design?

From this survey it was hoped to identify a number of 'proactive' design consultancies that have already included an environmental perspective within their everyday business management and project work and to utilise such consultancies in further in-depth studies to obtain more detailed information regarding environmental design practice.

The pilot study was carried out in early 1994. At a similar time members of the UMIST branch of the Design Innovation Group (DIG) were organising an extensive survey of the UK design consultancy industry which involved contacting over 600 consultancies country-wide. As noted in Chapter Three, this was viewed as a good opportunity to obtain a wider sample to provide information on environmentally responsible practices. The UMIST (DIG) therefore included a question in their survey on whether the consultancy had incorporated an environmental policy within their general company policy.

4.2.2 The survey design

This has been discussed in greater depth in the previous chapter. To summarise, the survey was designed to highlight the degree of environmental awareness and action within the British design consultancy industry. Environmental issues are increasingly affecting areas of design and manufacture across a wide spectrum of product groups by means of legislative, regulatory and voluntary guidelines. The actual impact of these initiatives has, as yet, not been analysed from a design perspective. It was felt that this was a crucial area to survey because of the pivotal position of design in the product development process.

The aims of the survey were to ascertain to what degree environmental awareness had filtered through to designers who were directly involved in design and development work. Those designers who work within the consultancy industry were considered an appropriate sample to survey because:

- Many designers in consultancies work individually or in small teams on a particular project and would therefore be required to have a relatively good knowledge of external factors such as forthcoming legislation that would affect the product being designed (such issues would usually be included in the design brief).
- Increasingly companies are taking an environmental stance, some are developing environmental policies that affect all aspects of the company practice, including design and development. The majority of design consultancy work is contracted in from outside and in so doing, consultancies would find themselves in the position of having to satisfy the demands of the client, consideration of environmental factors being among those demands.

It was decided to survey design consultants working in the areas of packaging and product design. These two design areas, particularly packaging, have been influenced by increasing amounts of legislation and other environmental initiatives since the early 1990's. It was likely therefore that designers working within these sectors would already have an understanding of environmental issues affecting design practices. Forty companies from across both sectors were chosen from the Directory of Designers published by the Design Council. Thirty product design consultancies and ten packaging / graphics consultancies were chosen. An emphasis was placed on the product design consultancies, as it was felt that this design area was likely to be affected by a wide range of environmental pressures, for example, the wide range of environmental legislation across different product groups. The product and packaging areas were targeted in order that a comparison might be made with in-house designers and design teams working in industry within similar sectors.

4.2.3 The questionnaire

The type of information required from this survey was to provide a basic understanding of how well environmental issues were integrated into design practice and whether there were differences in this integration between the design sectors. As has been previously mentioned, the survey aimed only to gather basic information from the design industry in order to roughly ascertain the priority of environmental issues within design consultancies.

The questions asked were kept simple and were split into the following three sections:-

1. General information regarding the consultancy practice - areas of specialist design , the number of employees and the number of trained designers as a percentage of those employed as designers.
2. The environmental 'awareness' of the consultancy as a whole - its understanding of 'environmentally responsible design', information required to achieve this, external environmental factors such as legislation that might affect the products it designs, and environmental 'benchmark' designers / design consultancies of which it is aware.
3. The more 'formal' side of integrating environmental factors within company practice, for example, whether or not the consultancy had an environmental policy and why.

The questionnaire was designed to be administered by post and to be returned in a pre-addressed envelope. Although the questionnaire was short (4 sides of A4 paper), it took a telephone follow-up to achieve an eventual fifty percent response rate.

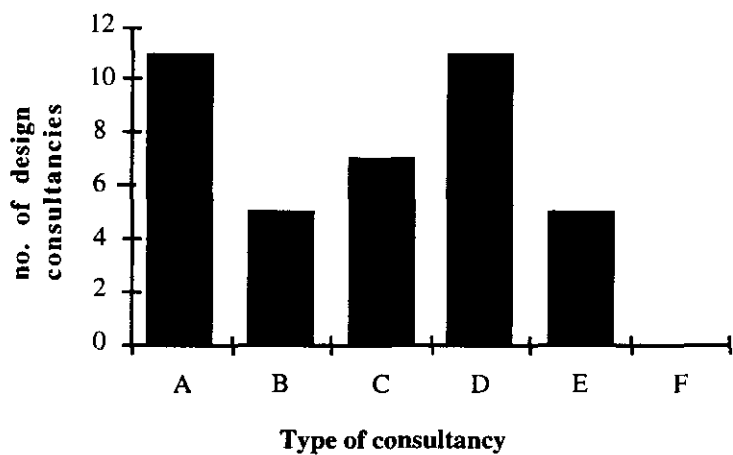
The questionnaire was addressed to the managing director of the consultancy and in most cases this was the person who responded. It was considered that this would be the most appropriate person to contact, as in the consultancy context the managing director is often a trained designer and a practising member of the design team. It also helped that the source of the sample, the Directory of Designers, generally stated the name of the managing director for each consultancy.

4.3 The results of the design consultancy pilot study

4.3.1 Company information

Question 1.1 asked the respondent to specify which areas of design the consultancy dealt with. The following options were available:-

- Product
- Engineering
- Packaging
- Graphics & Communication
- Interior & Exhibition
- Fashion & Textiles



sample:20
Figure 4.1

A - Product . B - Engineering . C - Packaging . D - Graphics and Communication . E - Interior and Exhibition F - Fashion and Textiles

The total adds up to more than the twenty consultancies that responded because all except one of the consultancies in the sample dealt in more than one design area. 40% of respondents specialised in two areas of design, 35% in one area of design , 15% in three areas of design and 10% in four areas of design.

The combination of design areas is illustrated in Table 4.1 below:

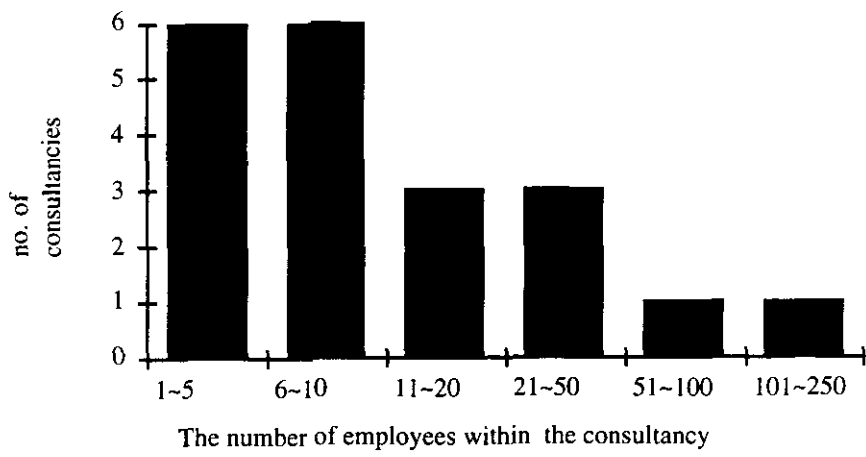
Code	Design Area(s)	No. of Consultancies
P	Product	3
	Product / Engineering	1
	total	4
M	Product / Graphics & Communication	2
	Product / Interior & Exhibition	1
	Product / Engineering / Packaging	2
	Product / Engineering / Packaging / Graphics & Communication	1
	Product / Engineering / Packaging / Interior & Exhibition	1
	total	7
	Packaging / Graphics & Communication	2
G	Packaging / Graphics & Communication / Interior & Exhibition	1
	Graphics & Communication	4
	Graphics & Communication / Interior & Exhibition	2
	total	9

Table 4.1

The codes **P**, **M** and **G** represent **product**, **multidisciplinary** and **graphic** consultancies respectively.

Question 1.2 addresses the employee numbers within consultancies and specifically, the number of people employed as designers and the number of those who were formally trained as designers.

90% of respondents employed fifty people or less, with 60% employing ten people or less ~ the majority of consultancies surveyed therefore were small.

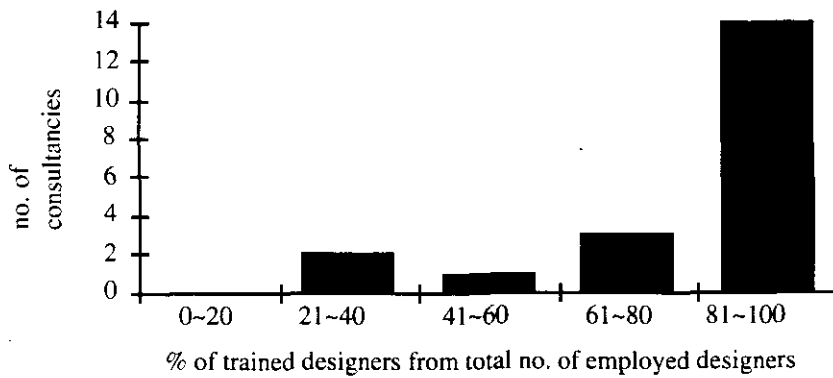


sample:20
Figure 4.2

Over half the respondents said that over 60% of their employees were employed as designers; of those staff employed as designers, the majority, 85%, had undergone professional design training.



sample:20
Figure 4.3



sample:20
Figure 4.4

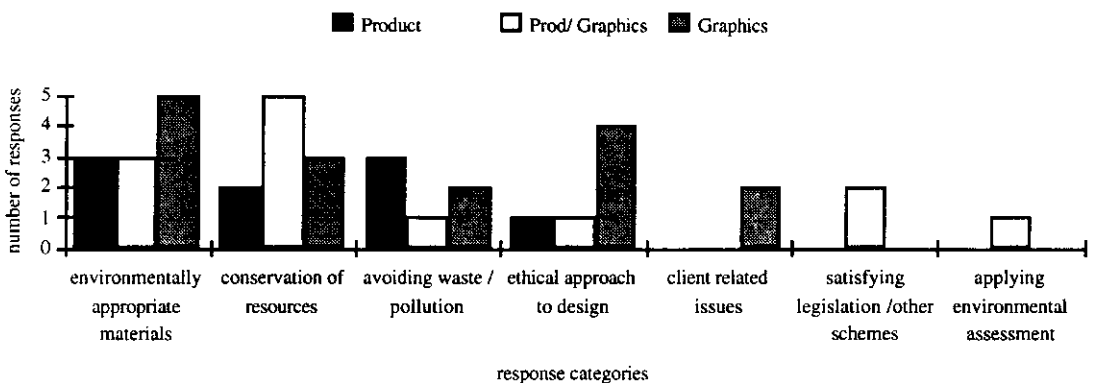
4.3.2 Awareness of environmentally responsible design

Question 1.3 asked 'Does your consultancy have an interest in environmental issues'?

In retrospect, the responses were probably what one would expect. Because of the increasing pressure to be seen as 'green', companies will no doubt be trying to reflect this image in some way. Thus it is not really surprising that, of those consultancies who responded to the survey, 100% responded positively. It is not possible to say on this information alone whether this is genuine interest, interest because of 'guilt' factors or interest because it is hard to respond negatively to such a topical subject or to such a broad question. However other responses from this survey do suggest that, although there may be genuine interest in environmental issues, there is considerably less practical action on those issues. This is not peculiar to the design industry, indeed such evidence has been found across the spectrum of service and manufacturing industry since the early 1990's. (Green & McMeekin 1994, Dauncey 1995, Walton 1991)

Question 1.4 asked respondents to briefly explain what was their company's understanding of **environmentally responsible design**.

A number of issues were raised in response to this question. This was an open response question with the replies being categorised under seven main group headings. For example, issues concerning the utilisation of **resources**. These response headings, the frequency of responses under each heading and the type of consultancy making the response can be seen in Figure 4.5 below.



sample:20
Figure 4.5

Emphasis on resource based issues

This divided into three main group areas

- environmentally appropriate materials
- conservation of resources
- avoidance of resource waste and pollution

The use appropriate materials emerges from the analysis as the most widely recognised topic regarding environmentally responsible design. The use of the most appropriate material

(for example, natural / man-made, virgin / recycled, toxic, biodegradable, local / foreign), in an optimum way was an area of common concern. **The conservation of resources** was seen by consultancies from all design areas as another main area of 'environmentally responsible design'. Statements such as '*design for disassembly*' and '*minimising waste through the careful design of products*' were among those made under this heading. Those consultancies grouped under product design mentioned issues concerning **waste and pollution** more than those involved in graphic design. Pollution produced during manufacture and during the life of a product were highlighted, giving rise to statements such as '*ensuring output (pollution) from the life -cycle of a product isn't harmful*'.

Ethical and social design issues was the second most common response after resource related issues, coming mainly from the graphic-oriented consultancies. Here there were a range of comments, some dealing with the actual product itself; '*not designing "unnecessary products"*', '*not contributing to addictive consumerism*' and '*product sympathetic to the environment in which it is to be used or displayed*'. Other comments dealt with more ethical issues an example being '*designers acknowledging the wider issues (beyond the ignorance of government / client attitudes)*'.

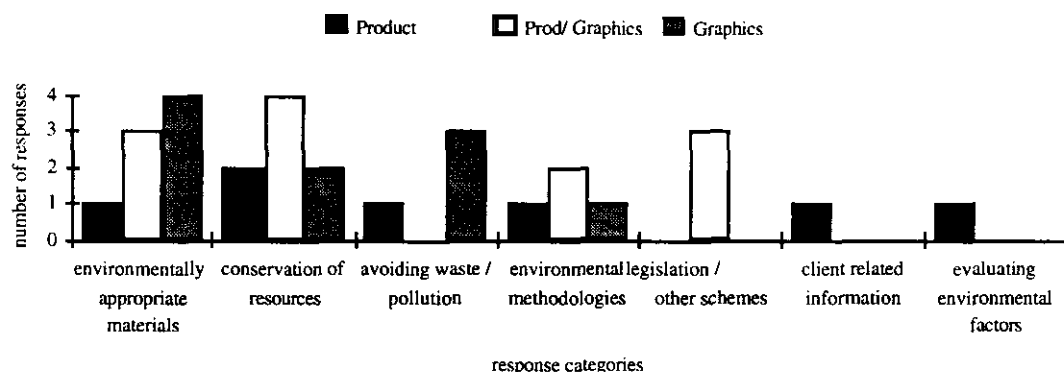
Some graphics consultancies suggested that environmentally responsible design included the '**designer - client**' working relationship where aspects such as '*educating the client on environmental factors concerning the design project*' or '*refusing to work with an environmentally irresponsible client*'. These consultancies indicated that by taking an ethical stance on the environment might mean the loss of a contract and therefore the loss of income.

Satisfying the requirements of Legislation and other schemes such as **Eco- Labelling** were mentioned by two multidisciplinary consultancies. One other multidisciplinary consultancy mentioned that environmentally responsible design related to the **implementation of an environmental assessment**.

Having asked what the respondents thought was meant by 'environmentally responsible design', question 1.5 asked **whether they thought further information was required to achieve environmentally responsible design practice, (i.e. design that takes into account environmental impacts during all stages of a product life-cycle), and if so, on what subjects the information was needed?**

90% of respondents thought that further information was required to achieve environmentally responsible design. Those consultancies who disagreed with this were involved in product design.

A list of response headings, as in the previous question, were compiled in order to analyse the subjects in which consultancies considered information was needed. These categories, the frequency responses for each and the type of consultancy making the response can be seen in Figure 4.6



sample:20
Figure 4.6

The most frequent response to this question was again concerned with **resource related issues**, namely

Environmentally appropriate materials and the conservation of resources.

Product / graphics and graphics consultancies commented most on in this area.

Information was sought on *'recycling and disassembly techniques and trends'*; *'on the environmental impact of materials and processes (an internationally accepted table of ratings with this information)'*, on the *'true energy and by-product LCA for given industrial components ~ traced back to parts rather than complex assemblies'* and *'recyclable, non - toxic, more environmentally benign materials'*.

Resource waste and pollution issues were a particular focus of product and graphic based consultancies. For example, they highlighted the need for information on *'disposability- environmentally sensitive resource disposal'* and *'treating and eliminating waste from manufacturing processes.'* A greater number of graphics consultancies rather than product consultancies mentioned the need for information on *'less environmentally damaging manufacturing process methods'*. This result was surprising as manufacturing does seem to fall more into the domain of product design. However, part of the reason for this could be due to the increasing amounts of recycled material used in graphic / packaging design and subsequent need to achieve good quality printing on recycled material, to have a wider range of water based inks and more environmentally benign adhesives in packaging so that the whole concept of 'greener' graphics can be addressed. The paper and packaging area has had a high media profile regarding its potential for damaging the environment and this has no doubt spurred on the demand for material and manufacturing process initiatives in this area.

Concern over the lack of information on **methods of environmental analysis** such as Life Cycle Analysis (LCA) occurred across all consultancy types and the need for up-to-date **legislative information** (eco-labelling was mentioned as part of this) was highlighted by a multidisciplinary consultancy. One product consultancy thought information was required

on issues such as '*persuading the client of environmental issues*' and on the area of '*evaluating environmental information to aid decision making*'.

The responses to questions **1.4** and **1.5** show that there are indeed commonalities between what is perceived as being 'environmentally responsible' design and what information is required to achieve this. Both results focus primarily on the area of resources and ways in which these resources can be utilised more effectively. Resource conservation issues such as recycling, reconditioning, reuse and longer life for products are raised and it is obvious, even from this small sample of design consultancies, that designers consider that there is a need for further information to be made available.

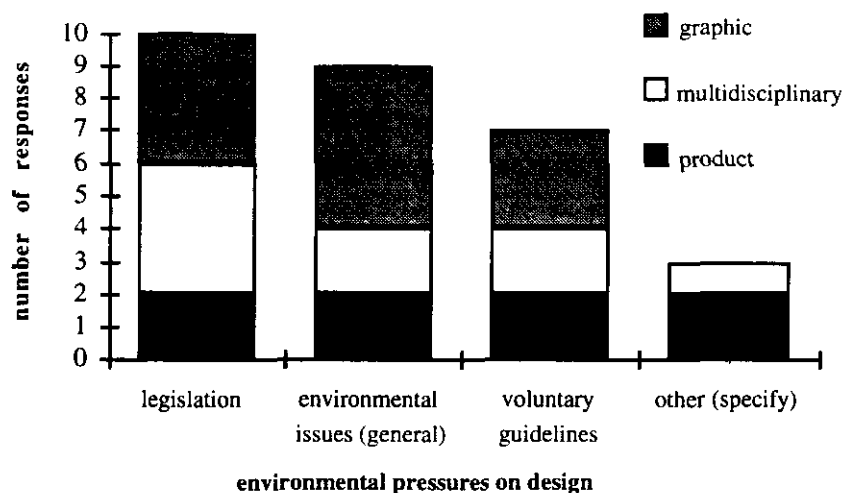
Question **1.6** asked the respondent '**Is your company aware of external environmental regulations that will affect the products your company designs?**'

The options that were given for the respondent to tick yes or no to were;

- Legislation
- Environmental issues impacting on business
 - e.g.. competitive market*
 - media pressure*
 - consumer expectations*
- Voluntary Guidelines
 - e.g. local business club initiatives*
- Other

40% of consultancies did not respond positively to any of the options. There were both product and graphic design consultancies in this group. Nearly a third of the respondents gave three or more positive responses to this question and the remaining third said they were aware of one or two of the options presented to them.

If they replied 'yes' then they were asked to specify what the environmental issue was and how they were made aware of it. The results are indicated in Figure 4.7.



sample:20
Figure 4.7

50% of consultancies said 'yes' to being aware of legislation. 45% said 'yes' to being aware of environmental issues impacting on business. Those consultancies involved in graphics and communication seemed to be more aware of these issues, product design consultancies being next. 35% of consultancies, from both product and graphics areas, said 'yes' to being aware of voluntary guidelines. 15% said 'yes' to 'other', all were involved in product design. Sensible use of materials, economic use of energy and manufacturing techniques were responses that came under the category 'other'.

The following table indicates the percentage of each type of consultancy who responded to each environmental pressure on design. The numbers in italics show how that percentage arises from the frequency counts from each type of design consultancy.

Awareness of Environmental Pressures on Design

Type of consultancy	Legislat ⁿ	Enviro. Issues	Voluntary Guidelines	Other (specify)
PRODUCT ⁴	50% <i>2</i>	50% <i>2</i>	50% <i>2</i>	50% <i>2</i>
MULTI ⁹	57% <i>4</i>	29% <i>2</i>	29% <i>2</i>	14% <i>1</i>
GRAPHIC ⁷	44% <i>4</i>	55% <i>5</i>	33% <i>3</i>	

Note: Some consultancies gave more than one response

Table 4.2

Consultancies were made aware of these issues through a range of channels - literature; media; trade associations - including The Chartered Society of Designers (CSD), Design Manufacturers' Association (DMA), International Council of Societies of Industrial Design (ICSID) and the Industry Council for Packaging and the Environment (Incpen) - general observation; suppliers information; client design briefs and government initiatives, for example, the DTI / Environmental Council Business and Environment Programme. It was also suggested that there was an increasing transfer of environmental information from design counterparts in countries such as Germany and Holland, particularly in the area of packaging.

Question 1.7

The final question in the 'environmental awareness' section of the questionnaire asked consultancies to list any design consultancies and / or design areas which they considered to be 'benchmarks' in terms of environmentally responsible design in the British design industry.

Most respondents left this question blank or replied 'don't know'. This suggests that either no one group / company or design area is pushing the boundaries forward in environmentally responsible design or there are examples of good environmental design practice initiatives but these are not being widely publicised or communicated.

Those consultancies which did comment mentioned the following:-

'ourselves' - one multidisciplinary consultancy had won the RSA Green Product Award and the BBC Environmental Award.

A product design consultancy mentioned *Dragon Design International* for 'green' design practice and *The Ecological Design Association* for the more social / ethical aspects of product design. Victor Papanek and disciples were mentioned for ethical aspects of design outside Britain.

Another product consultancy said *'none'* but went on to suggest that this was because *'commercial (marketing and advertising) forces manipulate what little good work is done.'* This comment highlights the publicity of the dubious environmental claims made by manufacturers regarding their products in the late 1980's and early 1990's; this became an unfortunate feature of 'green' marketing at this time.

'None' was also the comment of a product and packaging consultancy who went on to say *'Nobody is setting standards that are broadly applied and broadly communicated'*.

In general terms it would seem that from this response there is little awareness within the UK design industry of companies, individuals or associations that have showed a lead in environmentally responsible design to date.

4.3.3 Environmental policy

Question 2.1 asked consultancies **whether or not they had an environmental policy**. In retrospect the question should have ascertained whether the policy was of a 'formal' or 'informal' nature. However at the time of compiling this questionnaire the importance of this distinction had not been realised and hence respondents seem to have perceived the question to mean a 'formal' environmental policy. Some responded 'no' to this question and then went on to explain that they did operate an 'informal' environmental policy within the consultancy.

The results indicated that there was little commitment to having an environmental policy. Only one consultancy specialising in product design said they had an environmental policy and went on to describe it as 'awareness' ~ clearly not indicating a 'formal' environmental policy. Of the 95% that said 'no' to this question, approximately one third indicated that they

employed some form of 'informal' environmental policy. These were a mixture of consultancies specialising in product and graphic design. It seemed that these consultancies did not have a formal policy because they did not know how to devise one or felt that it was not appropriate to implement a formal policy. As one respondent said, *'this is not a negative reply. There is no sound basis for structuring a formal policy beyond innate concern and awareness.'*

If the response had been negative to the above question, the respondent was then asked to consider whether the consultancy would be planning to introduce an environmental policy within the next two years,

'Is your company planning to introduce an environmental policy, or likely to do so, within the next two years?'

20% of respondents said 'yes' to this question. Amongst the comments on why 80% of consultancies did not feel it appropriate to adopt an environmental policy were;

- ~ no financial incentive to adopt a formal policy*
- ~ the practical problem of enforcing a consultancy's own philosophy onto clients*
- ~ practical and commercial constraints upon 'good intentions' in design*
- ~ lack of co-operation / support from the business world.*

Question 2.2 asked whether the environmental policy had been implemented to the extent that it satisfied the environmental objectives the consultancy set out to achieve.

This question was left blank by most respondents as it was not appropriate for consultancies to reply. One consultancy did however mention the national environmental awards they had achieved through their design work and that they had an 'unwritten' policy.

Question 2.3 also was not answered . It asked for the person accountable for ensuring the implementation of environmental policy within the company.

However two consultancies stated that everyone was responsible, *'all were aware, all should take responsibility'*.

Finally, question **2.4** asked respondents to **prioritise the five main reasons for your consultancy having, or considering having, an environmental policy.** From the previous responses this question might be considered as inappropriate for the majority of the response sample to answer. Nonetheless, fifteen of the twenty replied to this question. It may therefore be a question of analysing a hypothetical response or it may in fact reflect the 'informal' policies of the design consultancies.

Reasons for having an environmental policy were given and from this list the respondents were asked to choose the five main reasons for their consultancy to have, or to consider having, an environmental policy.

The results are given in Table 4.3.

Reasons for considering having an environmental policy	Ranking					Unweighted Total (no of responses)
	1	2	3	4	5	
	number of responses:					
Company Business Philosophy	8	1	1	0	3	13
Pressure from client	4	2	3	0	3	12
Marketing Advantage	1	3	3	2	1	10
Legislation	3	3	2	1	0	9
Pressure from employees	1	2	1	1	1	6
Industry Association Policy	1	0	0	2	2	5
Other (specified below)	2	0	1	0	0	3
Ranking 1 (x2) - 'common sense'						
'product economics'						
Ranking 3 - 'conscience'						

Table 4.3

The unweighted totals (total number of responses) show that 'Company Business Philosophy' is the most important reason for considering the introduction of an environmental policy, it was awarded a rank of '1' by an equal number of consultancies specialising in product and graphic design. The respondents' interpretations of a company business philosophy was that of a mission statement and overall aims and objectives of the company (which may well take into account the internal assumptions of the firm of potential markets and technological trajectories, but the respondents did not specify this). 'Pressure from clients' was the second most frequently mentioned reason for considering an environmental policy - consultancies specialising in graphic design prioritised this more than those working in product design. Marketing advantage was ranked the third most important reason while legislation was ranked forth - both results were extremely close. Consultancies involved in product design prioritised 'legislation'. Analysis showed that 'employee pressure' came next in the list of reasons. The last two reasons were again very close. Industry Association policy totalled 5 responses whereas 'other' - ('common sense', 'product economics' and 'conscience' - all mentioned by consultancies specialising in product design) - totalled 3 responses.

More than half of the respondents were willing to be contacted again which might be an indication of the level of interest or concern on the subject of environmentally responsible design.

4.3.4. Conclusions of design consultancy research findings

Clearly these results only represent the views of a minority of the design profession, a small sample of mainly product and graphic oriented consultancies. What is of importance here is that the results show trends within the design profession towards a greater understanding of the need to incorporate environmental issues within the design brief and within design thought and practice in some way.

The majority of respondents for this survey were more graphic design oriented than product design oriented although of the original sample mailed, three quarters of the consultancies were taken from the product design section in the Design Council's Design Directory (1991). It is difficult to say from such a small sample whether this response indicates a difference in attitudes to the environment within these two design areas. The higher response from graphic design companies might suggest such an interpretation. The majority of respondents indicated that (not surprisingly) a high proportion employees working as designers had a design training. This supports the argument that British design education has a very important role to play in promoting environmentally sensitive design within all areas of design and through the variety of institutions that specialise in design training.

The responses to question 1.4, (Briefly explain what your company's understanding of environmentally responsible design is), and question 1.5, (Do you consider that further information on ecodesign is required to achieve environmentally responsible design and if so, in which subject areas is this information required?), clearly indicated that not only did the majority of designers in both graphic and product design consultancies believe that resource and waste issues such as,

- use of environmentally appropriate materials
- conservation of resources
- resource waste and pollution

were the key areas associated with environmentally responsible design, but also the main areas in which respondents thought further information and guidance were needed.

The areas covered by the responses were similar for both of these questions although there were a few differences; the 'ethics' of designing was mentioned by all types of consultancy when asked to describe environmentally responsible design, although it was not mentioned as an area where further information was needed by any consultancy. Graphic based consultancies saw 'the client' as the main barrier or opportunity for achieving environmentally responsible design. The product based design consultancies supported this

point in the sense that they saw the design-client relationship as an area where more information and advice was needed in order for environmentally responsible design to be achieved.

In analysing what consultancies saw as the main external factors that would influence their environmental practice, the majority saw legislation and general environmental issues impacting on business (for example, the competitive market, prolonged media attention, increased consumer expectations for 'greener' products) as the main reasons for change. Further discussion with staff of design consultancies, while chasing up responses for this survey, suggested a number of possible reasons why ideas and intentions on environmentally responsible design have not yet been effectively put into practice;

- restrictions of the client brief, which, for example, specified materials etc., and thus gave little room for manoeuvre;
- short deadlines, which did not allow enough time for individual projects to work to environmental criteria;
- no pressure from most clients to reduce environmental impacts of products, or no incentive to become pro-active in this area within the consultancy (given a common perception that this will incur added costs);
- confusion over the issues surrounding environmentally responsible design, for example, no clear direction and guidance within industry sectors; little understanding of the more 'scientific' information produced to date (i.e., on LCA).

4.4 Design innovation group [DIG], UMIST design consultancy survey - a question of 'policy'

The question of whether consultancies in the UK Design Industry have environmental policies or not remains unclear. At the time of compiling the design consultancy pilot questionnaire and the question on environmental policy for the larger design consultancy survey conducted by UMIST, the difference between 'formal' and 'informal' policy was not fully recognised. Hence there was no distinction made between 'formal environmental policy' and informal environmental policy' in the questionnaire. The DIG (UMIST) project surveyed 600 consultancies in all and achieved a 31% response. Of the 186 consultancies that responded, 38% replied positively to the following question;

'Does your company have an environmental policy?'

The results of the pilot design consultancy survey indicates that there seems to be much confusion over what could be thought of as an environmental policy and what would be classed more as a company 'attitude'. The majority of design consultancies do not appear to

have a formal, written environmental policy, however there do seem to be a number of consultancies that have an informal (often spoken) 'mission' addressing environmental issues. The reasons for not adopting an environmental policy range from the costs of implementation to the commercial and client related constraints. Small companies, (which the majority of design consultancies are), in other areas of industry give similar reasons for not having an environmental policy, particularly the 'added cost' factor; they tend not to have 'formal' business policies at all, but operate instead on a more informal, 'as and when necessary' basis. [The Engineer, April 1993, p 24 & Sept. 1994, p28; ENDS Report 227 pp22-24 (1993)]

Although there is a general awareness of environmental issues in the UK design consultancy industry there is little action to back up and support a change in business practice. Some argue that such change will only come about in response to legislation, European Union policy initiatives or increased pressure from the market. In the present business climate there is little chance of design consultancies taking environmental issues into account as a matter of course. It is even less likely that designers will act pro-actively to decrease the impact of the products they design. Question 2.1 of the pilot survey identifies possible reasons why designers feel that they have limited scope to implement an environmental perspective within the design process;

- ~ *no financial incentive to adopt a formal environmental policy*
- ~ *the practical problem of enforcing a consultancy's own philosophy onto clients*
- ~ *practical and commercial constraints upon 'good intentions' in design*
- ~ *lack of co-operation / support from the business world.*

Such comments reflect the 'reactive' environmental attitude and action of the design profession where the perceived 'scope for change' rests firmly with the client, the consumer and the market but not with the designer. This perspective of the designer's role in influencing more environmentally sound design opposes that of Papanek (1995) for example, who presents the designer as the 'solver of problems',

'There is a sense of wonder, a feeling of completion in design that is lacking in many other fields. Designers have the chance to make something new, or remake something so that it is better. We are the only time-binding' animal, communicating skills, ideas and acquired knowledge across the generations, and so we anticipate many possible futures; the job of designers and architects therefore includes a certain degree of prophecy.' (page 7)

Perhaps the true role of the designer lies somewhere in the middle of these two different perspectives - this concept is discussed later in the thesis in Chapter Eight.

Design has a crucial role to play in the development of products and thus can influence to a large extent the degree of impact on the environment that these products have. From the responses to this survey it is clear that the UK design profession is aware of many of the issues that are pertinent to eco-design, for example, conservation of resources, extending

product life, facilitating reconditioning within the original design. However it is also clear that there was very little action in the mid 1990's to put any of these ideas into practice. Indeed, designers felt they had relatively little influence on the greening of design.

4.5 The design-based company pilot survey

4.5.1 Aims

The manufacturing industry telephone survey was carried out in the summer of 1993. The purpose of this survey was to establish the current state-of-the-art attitude to the inclusion of environmental criteria within design and development practices and to identify a number of companies for possible further in-depth interview studies in three areas of manufacturing industry, namely:

- **White Goods**
- **Packaging**
- **Furniture.**

The sample was sought randomly from the Kompass Business Directory with the only criteria for selection being that the company was involved in the manufacture of a product or products and based in the UK.

4.5.2 Company sample

As previously discussed in Chapter 3, [3.6.1 (b)], these areas were chosen as each was subject to some form of environmental pressure, for example,

White Goods	energy labelling and ecolabelling.
Packaging	disposal issues particularly focused on food packaging. Regulation concerning recycling and incineration being developed.
Furniture	no specific legal environmental requirements, but an emphasis on timber sourcing and resources particularly from the supplier level.

All the analysis presented here is based solely on the companies that agreed to participate; for example, the size of companies relates only to the companies interviewed and not to all the companies approached.

There was a wide range of reasons for companies not wishing to participate in the survey, including the following:

- lack of time
- no manufacturing facility in the UK
- not interested, not willing to participate
- subject perceived as not being relevant to company operations

50% of the companies approached took part in the survey.

4.5.3 The questionnaire

The questionnaire comprised of simple and short questions addressing the design and development elements of the company practice and also the companies environmental credentials - in terms of attitude and action. The preferred respondents were technical managers or directors or design managers, however, in some cases, where these personnel were not available for comment, environmental managers and marketing personnel were questioned instead. All questionnaires were administered by telephone and took, on average, ten minutes to complete

The questionnaire design is discussed in Chapter Three and is reproduced in Appendix 1B

4.6 The results of the design-based company pilot survey

4.6.1 Company Information

A similar number of packaging and furniture companies were approached. However, the UK white goods industry is relatively small and this is reflected in the smaller number of companies approached compared to the other two sectors.

<i>Industry sector</i>	<i>No. of companies approached</i>	<i>No. of companies interviewed</i>	<i>Response rate</i>
White Goods	12	5	42%
Packaging	50	28	56%
Furniture	54	25	44%
<u>Total</u>	116	58	50%

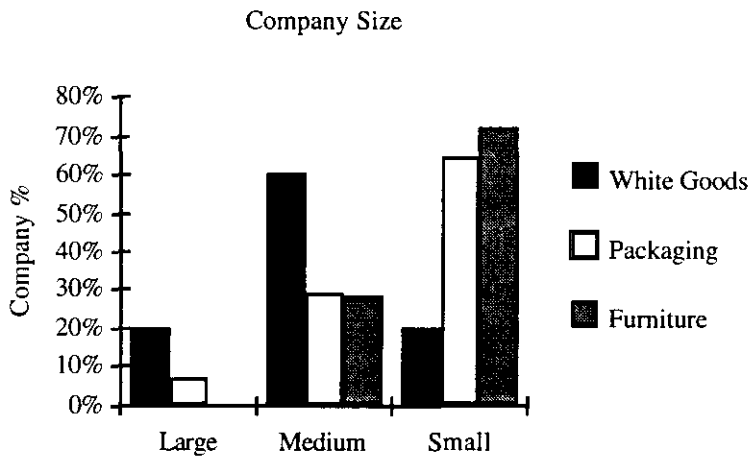
White goods respondents came from one large company, three medium size companies and one smaller company. All of these were part of larger groups based abroad.

Both the packaging and furniture companies had a similar spread of companies of a medium and small size. Where:

small = <150 employees

medium = 151-500 employees

large = >501 employees



n=58
Figure 4.8

4.6.2 Description of companies manufacturing interest

White Goods

80% of respondents were involved in the manufacture of domestic appliances.

20% of respondents manufactured industrial cleaning equipment.

Packaging

In this sector the areas of manufacturing ranged from both plastic and card based products within both domestic and industrialised markets to specialised industrial packaging.

Plastics packaging

A total of 72% of all respondents were involved in plastics packaging. 84% of these were solely involved in plastics packaging, the remaining 16% were also involved with card and paper based products.

The plastics packaging respondents manufactured products such as:-

- household plastic packs mouldings
- plastic container packaging - boxes, bottles
- lightweight food packaging
- plastic carrier bags - printed

Those also involved with paper and card products manufactured:-

- paper bags
- corrugated board boxes
- printed paper and card products

Card based packaging

14% of all respondents focused solely on card and paper based packaging products.

Included among this product base were:-

- moulded fibre cartons
- corrugated board boxes
- cardboard containers
- direct mail and printed paper

Industrial and specialised packaging

14% of all packaging respondents fell into this category. This included manufacturing areas such as:-

- machinery packaging
- specialised aluminium packaging
- industrialised transportation packaging

Furniture

Office furniture design

44% of furniture respondents specialised in the manufacture of office systems, primarily constructed from wood:-

- office furniture
- desks and fittings
- modular office systems
- commercial furniture

Retail Furniture

20% of respondents were involved in the retail area.

This sector included the manufacture of:-

- retail furniture and fixtures
- retail refurbishment
- retail fitters

Plastic based furniture

24% of all respondents specialised in the production of plastic based furniture including:-

- laminated plastic furniture
- moulded furniture
- moulded fibreglass
- thermoplastic injected furniture

Miscellaneous

Finally, this section comprises of all other individual manufacturers that did not fit into any of the categories mentioned previously. This included 12% of all furniture respondents and their areas of manufacture included the following:-

- self-assembly garden furniture
- kitchen unit manufacturer
- architectural design consultancy with a specialisation in furniture design

4.6.3 Design information

The respondents were asked whether they had a research and development facility in their companies.

In the case of the packaging and white goods sectors the majority of respondents had an active research and development department. 100% of respondents replied positively to this in white goods and 80% of plastics manufacturers but this did not necessarily mean that R&D was based in the UK - 40% of white goods said that their R&D work was based solely abroad.

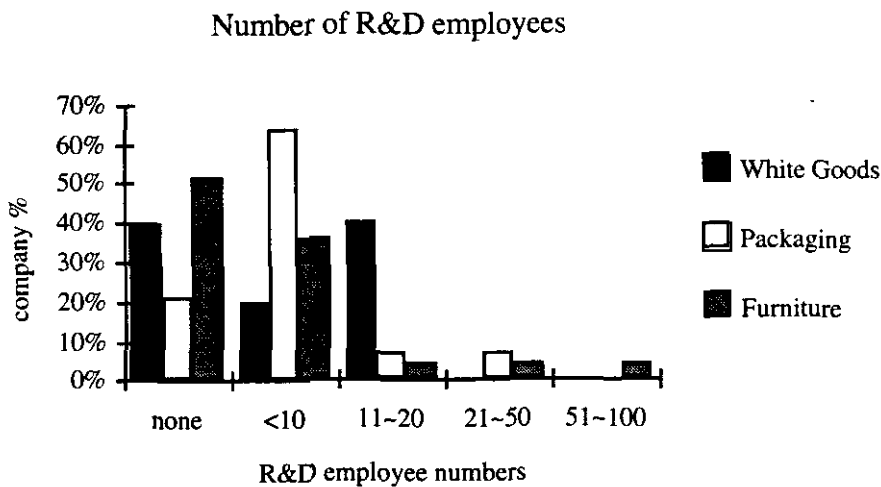
Furniture respondents were equally divided between having and not having an R&D activity.



n=58
Figure 4.9

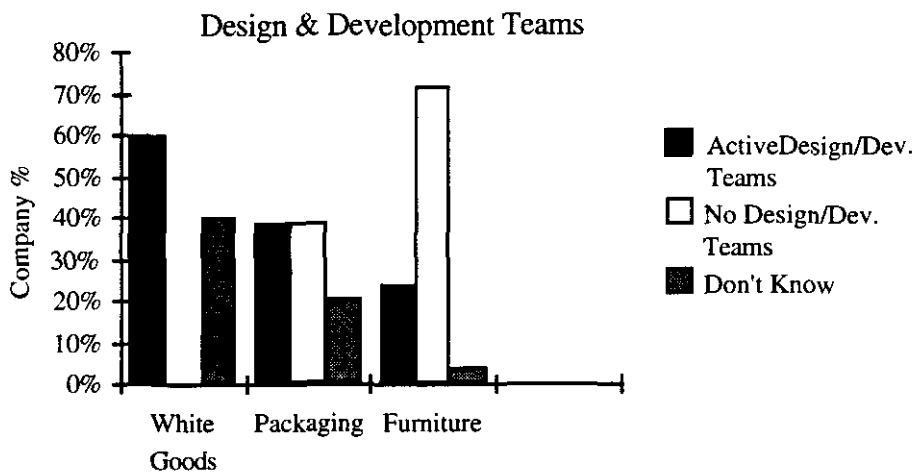
The number of R&D employees was counted as the number employed in the respondent's division in the UK if it was global company or part of a larger UK company.

The majority of companies that operated an R&D department had between 1 and 20 R&D employees, packaging and furniture divisions typically having between 1 and 10 employees, while the majority of white goods respondents that had an R&D department, employed between 11 and 20 R&D staff.



n=58
Figure 4.10

Based on a general understanding of what was occurring in design and development in their companies abroad, 60% of white goods respondents were aware of active design and development departments. This compared to 40% of packaging respondents and 20% of furniture respondents.

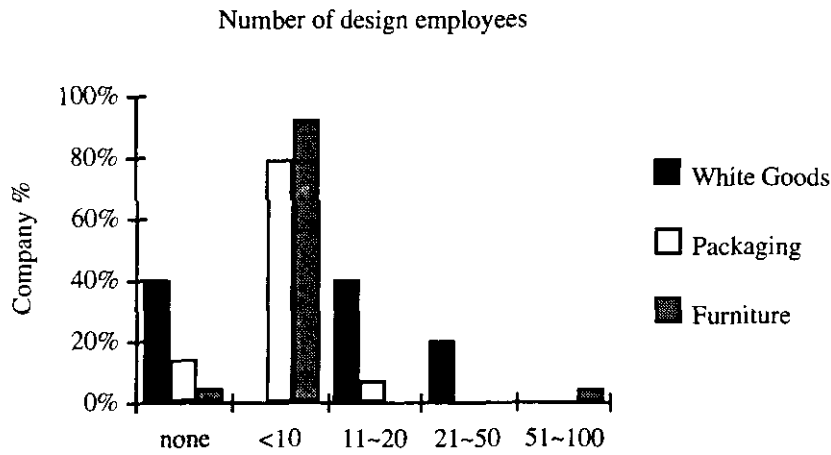


n=58
Figure 4.11

The majority of companies within both furniture and packaging sectors employed between 1 and 10 design employees. The majority of respondents from the white goods sector who had design and development activities employed between 11 and 50 design-based staff which is not surprising as they tended to be larger companies.

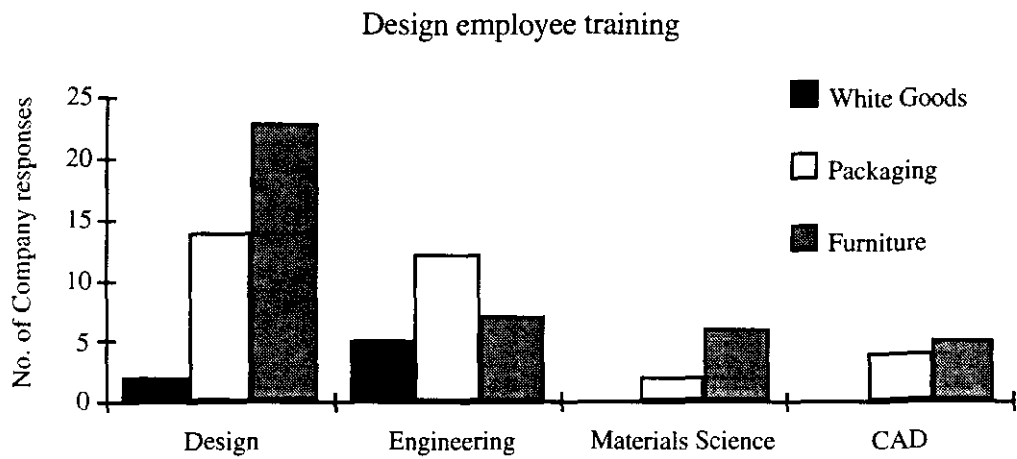
Although 70% of companies from the furniture sector said that they had no design and development teams, the majority of these companies employed designers. This ‘contradictory’ data suggests that there was some confusion regarding the term design and

development *team* within the furniture sector where maybe designers work in less formal *teams* than their counterparts in the other two sectors.



n=58
Figure 4.12

The majority of design employees in all industry sectors were trained in design or engineering. As would be expected a greater number of engineers were employed in the white goods industry compared to a greater number of trained designers in the furniture industry. Materials science and CAD trained employees were also mentioned by packaging and furniture respondents.



Note: Companies could make more than one response

n=58
Figure 4.13

4.6.4 **Environmental information**

The companies were asked to say whether environmental issues were impacting on company practice in any way. These results are interesting as the industry sectors were chosen where environmental issues were known to have a relevance.

Are environmental issues impacting on the company?



n=58
Figure 4.14

As can be seen, the white goods industry was adamant that environmental issues were impacting on their industry. Respondents from the packaging sector were also fairly certain that this was the case and issues such recyclability, waste minimisation and CFC's were mentioned at this point. Furniture respondents were a little less sure of the impact of environmental issues compared to the other two sectors, with over half responding negatively to this question.

This may be explained by the lack of environmental regulation within the furniture industry. Both white goods and packaging industries are subject to environmental legislation, whereas any environmental action in the furniture industry is more likely to emanate from voluntary guidelines and action. Legislation seems to heighten an awareness of the environmental issues and thus, would explain to some extent, the re-occurring pattern within this survey of furniture respondents being less aware of environmental issues and showing a lesser degree of environmental action than their counterparts from the other two industry sectors.

Respondents were asked whether they felt that there was a general environmental awareness within their companies.

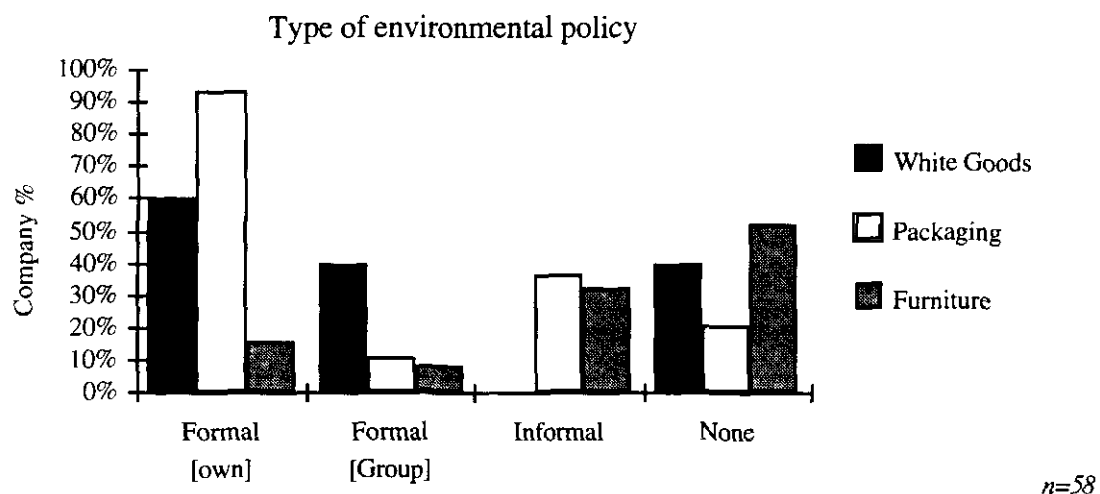
Is there a general company environmental awareness?



n=58
Figure 4.15

It has become evident through discussions with other researchers and with other manufacturers and through the literature{refs} that it is quite common for industry to perceive itself as being 'environmentally aware' whereas, in fact, when one investigates further, it is apparent that the company has a lot to achieve before it can make any environmental claims. Therefore it is not surprising to find in this survey, a degree of 'optimism' from respondents when asked to say whether they felt that there was a general environmental awareness within their company. The majority of respondents from all sectors replied positively to this question. However, it can be seen from other environmentally focused questions in the questionnaire that this is definitely not the case. We therefore have evidence of a superficial acknowledgement of environmental awareness but little evidence to back this up with actual company practice.

Respondents were asked to specify whether they had an environmental policy and if so, what type of policy this was (unlike the pilot design consultancy survey, the distinction was made between formal and informal policies for this survey).

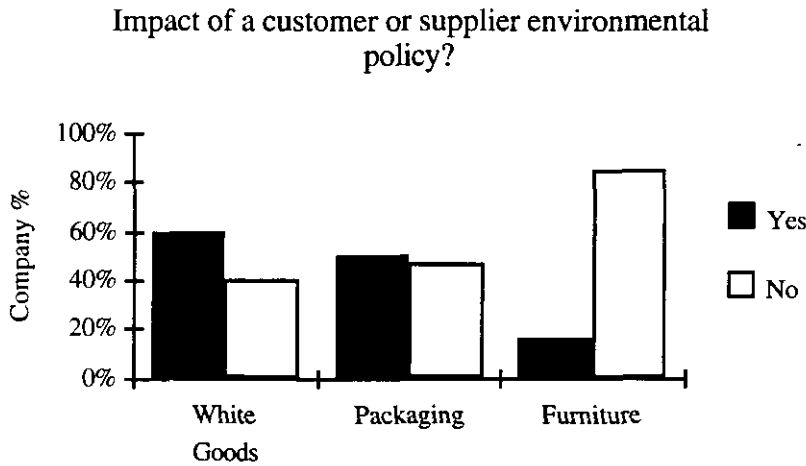


Note: Companies could make more than one response, for example respond for themselves and for the company group. Figure 4.16

The respondents in the larger companies within the white goods sector all claimed that their company had a formal environmental policy, although 40% of these acknowledged that the policy was a group policy and could not comment on the aims and objectives of their environmental policy. The remaining 60% who claimed to have their own environmental policy could not describe the main aims of the policy, however they all indicated that they would send a copy of the policy. None of these environmental policies arrived.

An overwhelming majority of packaging companies professed to having their own formal environmental policies. However very few of these respondents could describe the main aims of this policy and their responses to later questions led to serious doubts as to whether there was any substance to these policies and if there was, then why there was seemingly so little environmental action within those companies.

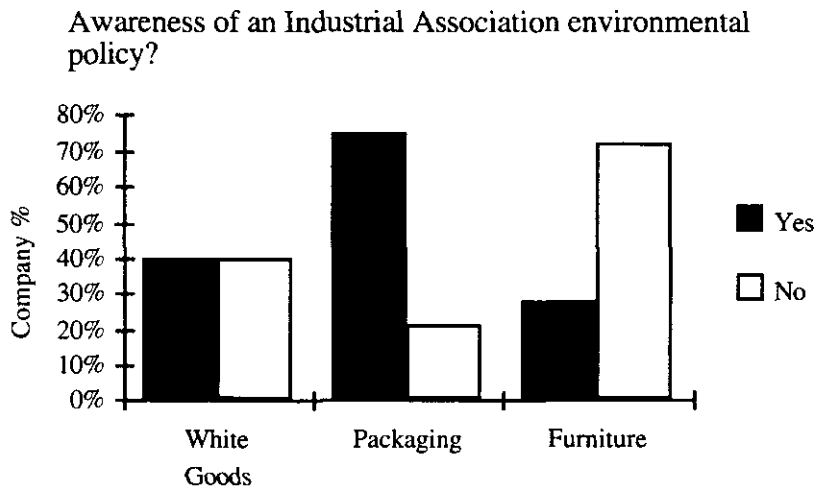
Over 50% of furniture respondents did not have any form of environmental policy and, of the majority of those who indicated that they did have an environmental policy, they had an informal policy which constituted '*an awareness of the issues*'



n=58
Figure 4.17

Note: Respondents who said they 'didn't know' are excluded from the chart and therefore figures do not add up to 100%.

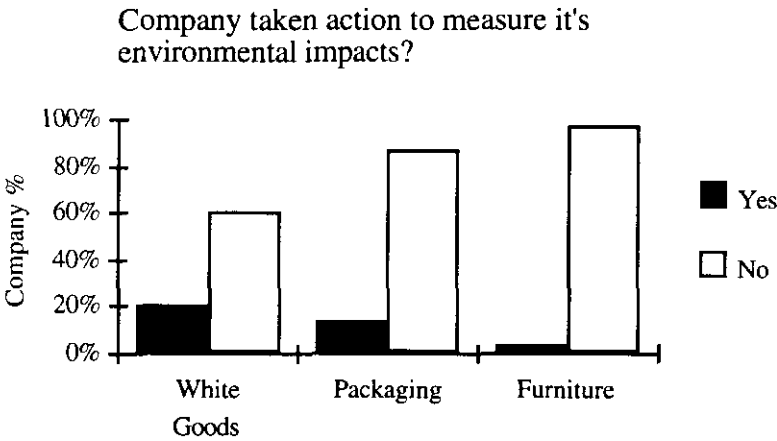
The white goods and packaging sectors had a similar percentage of respondents who had been influenced by a customer or supplier's environmental policy. The majority of these influences originated from customers and many of these were European based- in the case of packaging there was an emphasis on German legislation; here the environmental packaging laws have been much more stringent than in the UK. The Montreal Protocol and the environmental management standard, BS 7500, were also mentioned by packaging respondents as levers for introducing change from an environmental perspective within their company practices.



n=58
Note: Those companies who didn't respond to this question are excluded from the chart. Figure 4.18

The following organisations were mentioned by packaging and furniture respondents to the question of 'Does the company have an awareness of an Industrial Association environmental policy?:-

Packaging	Furniture
BPF [British Plastics Federation]	FIRA [Furniture Industry Research Association]
EPS [European Plastics Society]	
INCPEN [Industry Council for Packaging and the Environment]	
REPAK [Resource and Packaging Guidelines (1993)]	



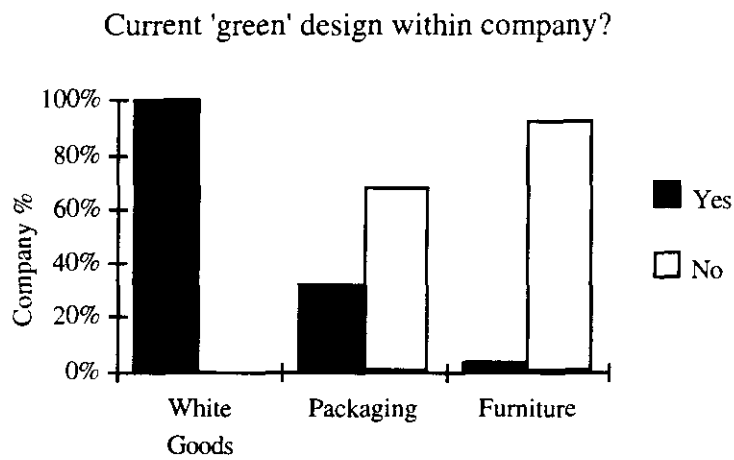
Note: Respondents who said they 'didn't know' are excluded from the chart n=58
Figure 4.19

If one compares the responses of the white goods and packaging sectors to the question concerning environmental policy, then the responses are quite surprising. It would have been expected for a company with a formal policy to be taking some form of action to measure their environmental impacts, yet the majority of respondents in all three sectors replied negatively to this question. The case may be that these companies are taking environmental action and the interviewees were not aware of this. Alternatively the environmental policy has been implemented recently and no formal auditing or measurement structure has yet been devised. However it could have been that no action was taken to monitor environmental policy implementation. Whichever reason applies, clearly virtually no action was underway to measure the companies' environmental impacts.

Respondents were asked to specify if they were aware of any mandatory or voluntary environmental schemes that directly related to their businesses.

- the environmental policy has recently been implemented and therefore action is currently at a conceptual level;
- environmental action may exist within the company but is not known to the interviewee responding to this survey.

The larger white goods companies may be implementing a greater degree of action than in the other two sectors due to the support they receive through the group structure and the greater opportunity for environmental action within a company that may have a greater amount of available resource specifically for environmental projects.



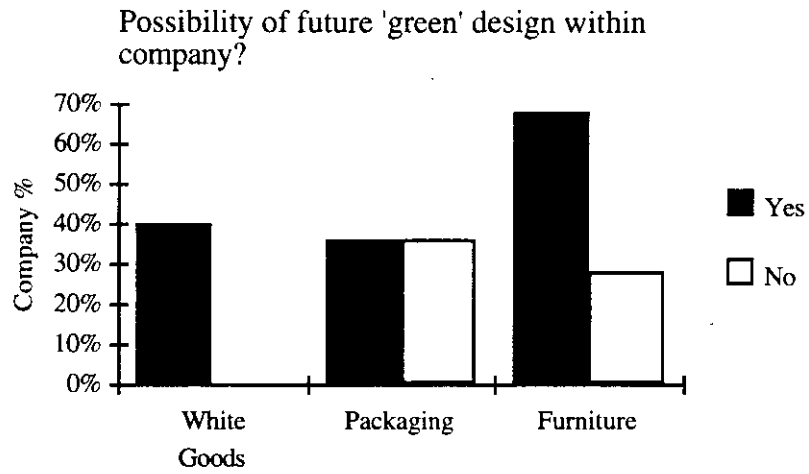
Note: Respondents who said they 'didn't know' are excluded from the chart n=58
Figure 4.22

When the respondents were asked: 'Is there existing green design within the company?', all respondents from the white goods sector replied positively. One white goods company mentioned that their current 'green' design work was an integral part of design and development research. Another placed it as part of health and safety design.

Just over 30% of packaging sector responded positively to this question. Among the reasons for including green design work within current practices were:-

- issues concerning resource depletion and reusability of materials
- customer demands for achieving a 'greener' product.

Only one company in the furniture sector responded positively to this question and did not present an example of their understanding of 'green' design.



Note: Respondents who said they 'didn't know' are excluded from the chart

Figure 4.23

All respondents replied more favourably to the possibility of introducing green design practices in the future. Many felt that this would become a reality especially if external concerns regarding environmental issues grew (for example, growing sensitivity over timber sources in the furniture industry, new regulations regarding pollutants in the plastics industry, etc.) The emphasis was firmly placed on being 'forced' to take environmental impacts into account in design rather than actively incorporating ecodesign as an intrinsic part of company philosophy.

The final two questions regarding environmental competitive advantage and marketing environmental credentials produced nearly identical responses from the three industry sectors.

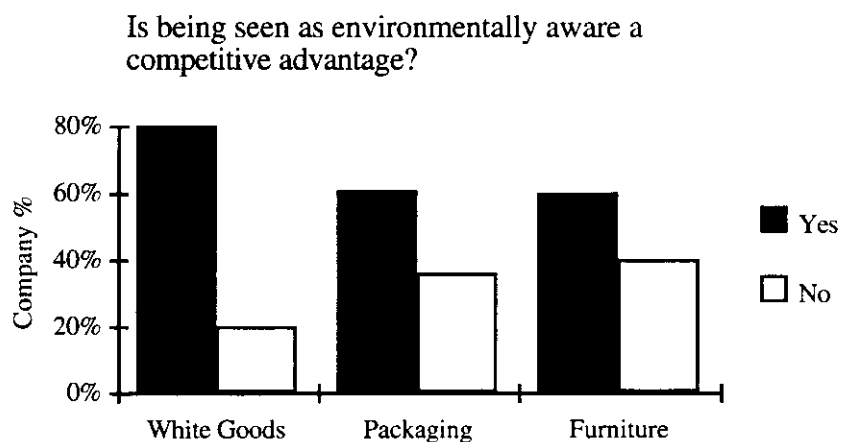
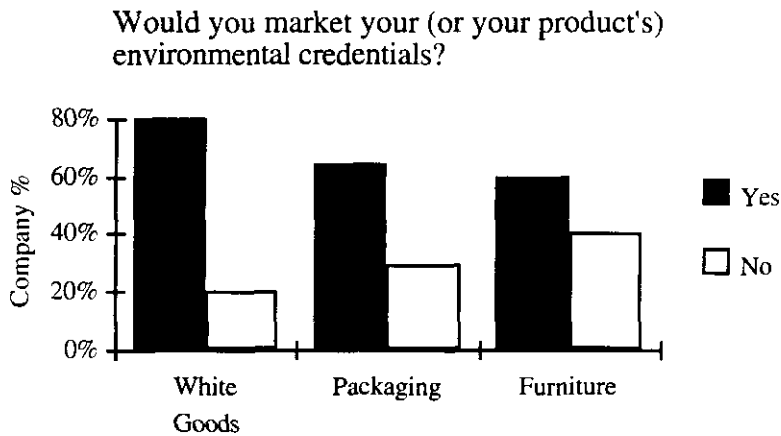


Figure 4.24

Those that replied positively to these two questions felt that it would be beneficial to see environmental awareness as a competitive advantage and / or to market their own environmental credentials, particularly as commercial trends are increasingly focusing on environmental initiatives, for example, green consumerism - a heightened market awareness of environmental issues. However, these responses must be viewed with a degree of

scepticism as none of the companies were following this type of marketing action at the time of this survey - a positive response to this question may well reflect the individual respondent's viewpoint and not that of company policy.



n=58
Figure 4.25

Some of those companies replying negatively to the question concerning the 'marketing of their environmental credentials' highlighted the following reasons:-

- would loose credibility within their market sector
- it would be a false selling point
- there is no demand for this.

4.6.5 Conclusions of design-based industry pilot study

This telephone survey provides an insight into the varying degrees of environmental awareness and action within the three industry sectors of white goods, packaging and furniture manufacture. It does not profess to be representative of these sectors or indeed, UK industry as a whole. It merely offers some illustrative examples of responses to a number of simple questions concerning company, design, and environmental information. The aim of completing a survey such as this was to gain an appreciation of the current state-of-the-art attitude to environmental issues within UK manufacturing industry. This has been achieved in the sense that a 'picture' has evolved of companies with both internal and external drives for implementing environmental action. The majority of these companies seem to be driven by external criteria such as legislation, standards and client and market pressures. Very few of the companies surveyed have integrated an environmental perspective within their business practices solely because of internal drivers to achieve better environmental standards. It may therefore be deduced that the majority of companies interviewed as part of this survey have been predominately reactive in their actions to introduce an environmental perspective within their businesses.

The aim of the telephone survey was also to look towards establishing a smaller sample group that would be suitable for a further in-depth study. Unfortunately due to the predominately 'reactive' nature of the responses obtained, it seems that the focus on the three areas of white goods, packaging and furniture has not identified a sample of more environmentally active companies. A reactive type of company would not be considered suitable for an in-depth research study where the main aim of that study is to understand environmental design practices in greater detail.

4.7 Pilot study research summary

Both the pilot postal and telephone surveys have produced illustrative material on environmental attitudes and current environmental practice in industry today. Presented below are a number of points that have been identified by these two studies regarding the introduction of environmental criteria within design, development and company business practice.

1. Design consultancies tend to operate on an 'informal' business level and therefore do not work with formal policies. Generally companies that had formal environmental policies had not implemented strategic environmental action, particularly at the design and development level. From a company perspective, there is a disparity between the perceived environmental awareness of companies and the actual practical environmental action taken by companies. This is illustrated in Figures 4.15, 4.16 and 4.21 on environmental awareness, environmental policy and environmental action. The majority of respondents confirm their company's environmental awareness, they acknowledge the existence of an (formal) environmental policy but when respondents are questioned on whether the company has taken any steps to measure their environmental impacts or to instigate environmental action, as in Figure 4.21, the responses are quite the opposite. It therefore seems evident that there is a gap between environmental policy and environmental action.

2. There seem to be very few environmentally responsible design initiatives being developed in the three industry sectors surveyed.

3. Compulsory drivers such as legislation, and external forces such as the client brief and market forces are more effective in introducing a change in company practice than the voluntary drivers such as voluntary labelling, and internal forces such as company philosophy or employee pressure. Hence those companies who have implemented some form of environmental initiative have tended to do so for 'reactive' rather than 'proactive' reasons.

4. There is much confusion regarding the meaning of environmentally responsible design and what this entails; material resource, waste and pollution issues are very much a focus which may have a lot to do with past 'green' designs publicised by the media.
5. The majority of designers in industry have been professionally trained and therefore design education must be seen as a key avenue to educating future designers on ecodesign philosophies.

4.8 Changes in the research design - a summary

The design consultancy pilot survey [including the UMIST (DIG) survey] produced some potential candidates for further in-depth research.

The results of the manufacturing industry study suggest that it will be necessary to look elsewhere for a manufacturing sample for a further depth survey. It is likely that the industry groups of white goods, packaging and furniture will be widened to include companies in other manufacturing sectors that have demonstrated some form of environmental proactiveness. Companies must meet at least one of the criteria below if they are to be considered as cases for the main research study.

The criteria for the main, in-depth research is one or more of the following:-

- A UK design-based company or consultancy.
- Publicising some form of 'green' credential.
- An active interest in the practice of environmentally responsible design in the UK
- A past or present green/ecodesign design project based in the UK
- Active in working towards, or having achieved, an environmental standard.
- Expressing an interest in environmental issues to the extent of forming some form of environmental policy.

The changes in the research design are discussed in Chapter Five along with the design and development of the in-depth survey questionnaire, based on the results of the pilot studies.

Revising the Research Design: An overview of the Pilot Study Results

5.1 Introduction

The aim of this chapter is to explain the changes in the criteria for companies to be interviewed in the main research study.

The exploratory results illustrated current environmental attitudes and action within design consultancies and design-based industry. This chapter presents an overview of these findings, a description of the original criteria for the choice of in-depth interviews and subsequent changes in this method in the light of the pilot study research results.

A description of the companies and design consultancies chosen for the in-depth interviews and the question themes of the main study will also be given before the main research results are presented in Chapter Six.

5.2 A summary of the pilot study research findings

5.2.1 Design consultancy postal survey

This survey portrayed a general picture of the attitude of design consultancies to incorporating environmental criteria within the design process. It was a small sample group of forty consultancies chosen randomly from the Design Council's Directory of UK based design consultancies; a 50% response rate was achieved. It is hoped that the random nature of the sample goes some way to producing 'generalizable' results concerning the current state of environmentally responsible design in UK design practices.

Key results from the design consultancy postal survey

- There seemed to be a great interest in environmental issues but little 'concrete' action to support this interest
- There were very few formal environmental policies but a number of consultancies mentioned an 'informal' policy on environmental issues, the majority of consultancies are small companies and small companies tend to operate on an informal level, i.e., policies of any type are not generally found in smaller companies.

Reasons for the lack of environmentally responsible design initiatives were given as:-

- Restrictions of the client brief and/or client's resistance to change
- A general confusion over the issues surrounding the meaning of 'environmentally responsible'
- No incentive to include an environmental perspective in design practice from
clients
government
the business world;

The present business climate does not encourage industry to adopt more environmentally benign practices. Therefore it is not unexpected that the design industry, as a small element within industry has not adopted a more environmentally responsible stance.

- The more environmentally responsible designs are often commercially 'mis-used'. One off 'green' designs are marketed by the company as comprehensive environmental action by the company. Initiatives like this stimulated Friends of the Earth to present the 'Green Con awards' to the companies responsible; this action helped minimise false green claims in the marketplace (see Chapter Two, 2.4.8).
- The majority of respondents indicated that a high proportion of employees working as designers had a design training. This supports the argument that British design education has a very important role to play in promoting environmentally sensitive design within all areas of design and through the variety of institutions that specialise in design training.

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- The majority of respondents indicated that a high proportion of employees working as designers had a design training. This supports the argument that British design education has a very important role to play in promoting environmentally sensitive design within all areas of design and through the variety of institutions that specialise in design training.

- The majority of design respondents equated environmentally responsible design practice to resource and waste related issues such as minimisation of materials, the use of renewable materials and reducing pollution.
- Resource and waste minimisation were also areas that the majority of respondents felt a greater amount of information was needed in order that environmentally responsible design could be effectively achieved.

The UMIST design consultancy survey showed that over 30% of respondents indicated that they had implemented some form of environmental policy. These design consultancies were followed up by telephone along with the more 'environmentally active' companies from the postal survey. From these a number of design consultancies were found for the main depth research study.

5.2.2 Design-based industry telephone survey results

This was a random survey of companies from the white goods, packaging and furniture sectors chosen from the Kompass business directory. The size and random nature of this sample should have produced some generalizable results concerning environmental attitudes and action in UK industry. As noted in Chapter Three, the sectors were chosen because it was felt all three had various environmental pressures acting on them; issues such as energy efficiency, use of material resources, sources of material resources, market forces and the European eco-labelling scheme.

The following conclusions were drawn from the survey results.

Key results from the company telephone survey

- Many respondents indicated that their companies had an awareness of environmental issues.
- Many of the companies, especially the larger companies, had a formal environmental policy.
- There was a distinct gap between environmental policy and environmental practice. Those companies that indicated they had a formal environmental

policy had not, in the majority of cases, implemented any form of environmental action.

- Environmental action that had occurred was predominately the result of external drivers such as:-
environmental legislation

environmental standards

client demands

market forces

Hence, those companies implementing some form of environmental initiative were generally *reactive* in their action.

- Designers employed by these companies had usually undergone a formal design training. This finding supports the need for ecodesign philosophies to be integrated within all design education.

5.3 Conclusions of the pilot study research

The common points raised by both the design consultancy and design-based industry surveys are:-

1. Design consultancies tended to operate on an 'informal' business level and therefore did not work with formal policies. Generally companies that had formal environmental policies had not implemented strategic environmental action, particularly at the design and development level and thus the evidence suggests that a formal environmental strategy is no guarantee of an environmentally active company. There seems to be a formidable gap between environmental policy and environmental action.
2. There are very few environmental design initiatives being developed across those industries highlighted.
3. It tends to be the medium to large company that have implemented a formal environmental policy; the smaller companies (which design consultancies tend to be), work in a more informal manner.
4. Compulsory drivers such as legislation, and external forces, such as the client brief and market forces, are more effective in introducing a change in company practice than the voluntary drivers such as voluntary labelling, and internal forces such as company

philosophy or employee pressure. Hence those companies who have implemented some form of environmental initiative have tended to do so for 'reactive' rather than 'proactive' reasons.

5. There is much confusion regarding the meaning of environmentally responsible design and what this entails; material resource, waste and pollution issues are very much a focus, which may have a lot to do with past 'green' designs publicised by the media.

6. The majority of designers in industry have been professionally trained and therefore design education must be seen as a key avenue to educating future designers on ecodesign philosophies.

5.4 A change in the research design method

One of the main aims of the pilot study research was to give an overview of the current awareness and action concerning environmental design initiatives in UK industry. The results of both surveys suggest that there is an interest in environmental issues in those companies and consultancies interviewed, however this interest is rarely accompanied by comprehensive environmental action. Although companies and consultancies state that they have an interest in these issues and that they may even have an environmental policy, there is little evidence to support this fact from the results to date. There seems to be an evident gap between environmental policy and environmental action. One reason for this is that environmental issues may be viewed as a 'sensitive' issue and those companies and consultancies interviewed might want to present an image of the caring business. It is suspected that many of the respondents truly believe that their business does have a concern regarding environmental issues and may be aware of a 'corporate' environmental policy. However, it is clear that, where it exists, the gap between devising an environmental policy to implementing it effectively still seems to be very wide. This finding fed into the main research study, which included investigating management and communication regarding environmental matters and where the design activity and the designer fits into this structure.

Another main aim of the pilot study research was to identify appropriate companies and consultancies for further study. In the case of the design consultancy sector a number of possible consultancies to follow up emerged from both the postal questionnaire and the UMIST design consultancy survey. Other design consultancies could be found from sources such as applicants for various environmental design awards or from the pre-launch company list of the British Standard on Environmental Management (BS 7750).

Unfortunately the telephone survey of the three industry sectors, (white goods, packaging and furniture), did not produce a sufficient number of companies that seemed appropriate for further study. Therefore this led to a revision in the original research design method.

The original aims for the main study as presented in Chapter Three were:-

- To establish what is 'best practice' in environmentally responsible design and how this has been integrated within design and development.
- To draw on examples found in companies through the exploratory research and through other companies that may have been identified; e.g. through the media, through environmental awards / standards, through PR events.
- To undertake case studies in a number of these companies concentrating on environmental issues within the design process and the dynamics between the design team and other groups involved in design and development.
- To effectively integrate with the design team through participant observation techniques.

The pilot study research results indicate that there are very few companies implementing environmental design initiatives. This was particularly true for the three sectors of industry surveyed by telephone. Therefore, to identify appropriate companies for the main study, it was decided to broaden the industry base and move away from the three sector focus to consider any company that satisfied the criteria for the main research study. However, the criteria for selecting the original three sectors (companies facing a mixture of environmental pressures and maturity of the issue) were retained.

Companies which had widely publicised their 'green' credentials (e.g., BT, Sainsburys, Tesco, Boots, B&Q) proved extremely hard in obtaining access. This may be due to these companies being approached by a large number of researchers; the result was that these companies seemed unwilling to co-operate on the author's smaller research project.

This resulted in a changing perspective for the main study. Instead of looking at 'best' practice in environmentally responsible design it was decided to focus the research upon 'better' practice in environmentally responsible design. It is unlikely that even the more 'proactive' companies have achieved 'best' practice in this area and therefore an analysis of 'better' practice seems more appropriate to current industry initiatives.

Due to fewer ecodesign initiatives in industry than originally anticipated, the concept of participant observation was revised to focus more on a semi-structured interview approach, obtaining additional information from company reports, other company personnel, journal

articles and the mass media. Possible sample companies seemed deterred by the concept of participant observation or even a formal, direct observational approach and therefore the revised aim of the main study was to focus on more companies across a broad scope of manufacturing industry and the design consultancy industry.

A summary of the barriers to satisfying the original main study aims are:-

- Lack of environmental knowledge and action within design related industries [particularly in the three industries chosen - white goods, packaging and furniture].
- Apathy to introduce change from an environmental perspective within the design process.
- An unwillingness to get involved with the research programme - particularly from those larger companies that had publicised their environmental credentials.

Revisions in locating a sample company base were:-

- To widen the industry based sector to any industry as long as it has a product design element.
- To predominately use the UMIST survey to identify appropriate design consultancies.
- To identify possible companies / design consultancies through a variety of different channels - the media, environmental standard applications [e.g. BS7750], other environmental surveys, personal communication, etc.

The revised main study aims therefore became:-

- To establish what is 'better practice' environmentally responsible design and how this has been integrated within design and development.
- To draw on examples found in companies through the exploratory research and through other companies that may have been identified; e.g. through the media, through environmental awards / standards, through PR events.
- To undertake case studies in a number of these companies concentrating on environmental issues within the design process and the dynamics between the design team and other groups involved in design and development.

- To use a semi-structured interview approach, incorporating direct observation and the use of information from additional sources.

These changes in the main study meant that a larger number of companies could be contacted and thus, a greater degree of information could be collected from companies with differing interests. A participant-observation method would have been extremely time consuming and would have allowed only a small number of companies to be studied in depth. Although the information obtained from this more intensive approach would differ from the information obtained from a semi-structured interview approach, the latter enables the researcher to gain a wider appreciation of the issues impacting on a broader scope of industry. This may be later applied to a participant observation approach in future research efforts.

The main criteria for further main study cases are three or more of the following:-

- A UK design-based company or consultancy.
- Publicising some form of 'green' credential.
- An active interest in the practice of environmental design in the UK.
- A past or current environmental design project based in the UK.
- Active in working towards, or having achieved, an environmental standard.
- Expressing an interest in environmental issues to the extent of forming some form of environmental policy.

5.5 Aims of main research study

Building on preliminary data established from the pilot postal and telephone surveys, the aim of the main study was to achieve an insight into how designers operate within a company/consultancy structure to include environmental criteria within the design and development process. This is an extremely new area of research and to date there is very little understanding of what the main criteria are for designers to adopt an environmental perspective within design projects. The rationale for undertaking a qualitative approach to this topic is discussed in Chapter Three, but it is appropriate to highlight the following factors that encourage this type of analysis:-

- It is a method by which one may glean a highly subjective and personal perspective of the subject under research.

- It provides a rich discourse from which to retrieve salient points which may well be lost through more quantitative methodologies.
- A more relaxed interview situation helps eliminate tensions/barriers that are generally in place between the interviewee and interviewer thus aiding the communication of often more 'delicate' and confidential information.

The aim was to highlight the realities of incorporating environmental criteria in design without the process being hidden behind a 'PR' environmental policy or initiatives from a marketing department. It was intended that the study would provide information on:-

- What was actually occurring in firms who are attempting to integrate an environmental perspective within their design and manufacturing process.
- How they are coping with new legislation and standards.
- How is the role of management and the relationship of designers to management changing in order to facilitate these environmental initiatives.

Although the criteria for the sample selection had been revised, as described earlier, there were still difficulties in obtaining a reasonable number of appropriate interviews, particularly in the consultancy sector. The majority of the design consultancies interviewed in the main research study were found as a result of their responses to the 'environmental awareness' question on the UMIST design questionnaire. Many of the companies interviewed for the main study were located as a result of their involvement with the BS7750 pre-launch environmental management scheme; some were also approached as a result of their environmental action being featured in media articles - for example, the winners of environmental management awards. Overall twenty in-depth interviews were carried out in person, ten in design consultancies and ten in companies. In addition one design consultancy responded by post. The companies and design consultancies were distributed throughout the following sectors:-

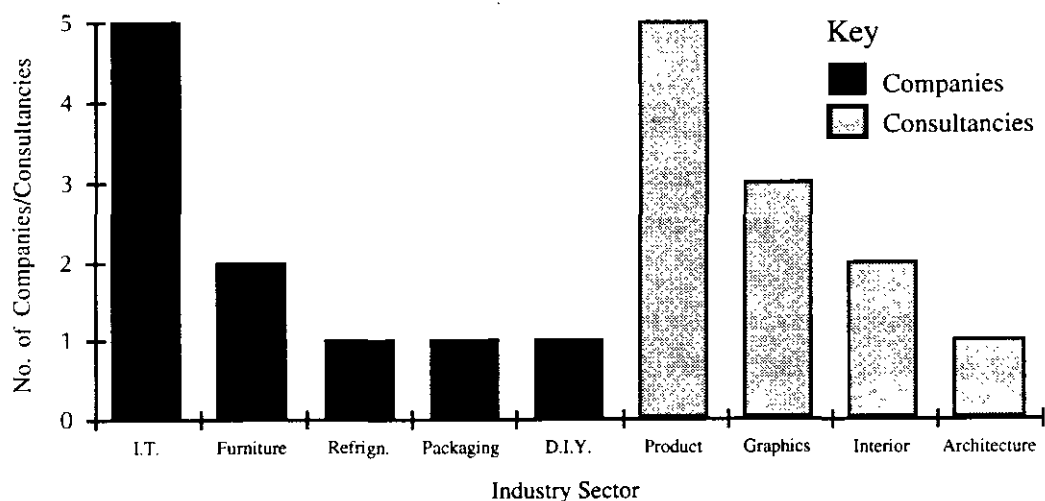


Figure 5.1

Overall the change in criteria for company selection had maintained, as the core requirement, that the company or consultancy had an active interest in environmental issues, although the degree to which this interest had been translated into action was expected to cover a wider range than in the original research plan. The revised methodology sought a wider range of companies; some of these would meet the initial criteria of comprehensive environmental action, some would only be beginning to think of the issues in connection with their business practices. All interviewees however, would have some direct input into design and development, whether they were designers, design managers or environmental officers overseeing environmental design policy.

5.6 The Interviews

Interviewees were generally design personnel, although in some cases the designer was also the managing director or the environmental officer. In three cases design personnel were not available to be interviewed and therefore the environmental officer or managing director was interviewed instead. It was important to obtain a 'design perspective' as much as possible in order that the realities of incorporating environmental criteria into the design and development process could be discussed. It was felt that a purely management perspective would not be appropriate as the relevant information would be too embedded within the actual design process. A person at a 'management' level within a company would therefore be unlikely to have knowledge of design and its relationship to environmental issues at the level of detail sought.

The interviews were completed over a period of 7 months from October 1994 to April 1995.

The interviews lasted between one and half hours and four hours and all but two were tape-recorded with full transcripts being made (see examples of transcripts in Appendix 1D).

5.7 A summary of companies and design consultancies chosen for the main research study

The sample has been coded for commercial confidentiality. A description of both companies and design consultancies follows.

5.7.1 The companies

COM001

Focus: Research, design and development of primarily telecommunications equipment for the IT industry. Main group's focus is PC technology .

Size/Position: 501+ employees

Design employees: approx. 80 research engineers - 10 of these are trained industrial or electronic designers.

Market: global

Turnover (1994): >£100m

COM002

Focus: Research, design and development of commercial refrigeration units for the food industry.

Size/Position: 101-500 employees. The biggest producers of this type of equipment in the UK. European holding group.

Design employees: 1-10, all are professionally trained.

Market: European

Turnover. (1994) > £20-100m

COM003

Focus: Research, design and development of DIY tools, primarily focusing on knives, blades and screwdrivers.

Size/Position: 501+ employees. One of the main UK companies in this field and hence market leader.

Design employees: 11-50, all are professionally trained

Market: European

Turnover (1994): £20-100m

COM004

Focus: IT - Research, design and development - focus on computer monitor design

Size/Position: 501+ employees. This division is the European monitor development centre.

Design employees: UK design team = 4 professionally trained design staff

Market: European

Turnover (1994): > £100m

COM005

Focus: Specialise in reproduction furniture manufacture and have won 2 environmental awards for design and for management.

Size/Position: Gp. employees = 101-500. Division of UK furniture and upholstery manufacturing group.

Design employees: 2 design personnel, 1 is professionally trained.

Market: global

Turnover (1994): £1-20m

COM006

Focus: Telecommunications equipment design - Focus on the development and manufacture of telephones

Size/Position: 501+ employees. Based in S. Wales is main supplier to main UK telecommunications company.

Design employees: approx. 8, all of which are professionally trained.

Market: UK

Turnover (1994): £500k -1m

COM007

Focus: The design and manufacture of PC and mainframe computers. Also invested in take-back strategies to deal with used equipment.

Size/Position: 501+ employees - Large UK IT company now part of a global company, HQ in Japan. Company is umbrella for many smaller subsidiaries.

Design employees: within subsidiaries - number not known

Market: global

Turnover (1994): £20-100m

COM008

Focus: Specialises in the design, development and manufacture of office furniture systems.

Size/Position: 51-100 employees. Established UK furniture manufacturer - originally set up by a furniture designer and therefore still strong design ethic. Now part of global group, HQ in the USA.

Design employees: 1-10, 40% of these have undergone professional training.

Market: mainly UK

Turnover (1994): £1-20m

COM009

Focus: Specialisation is the refurbishment and separation of used IT equipment - setting up the logistics for effective take-back policies.

Size/Position: Originally subsidiary of COM007 now an independent company, but with strong ties to parent company. A 'one man' led business.

Design employees: none directly, but information feeds through to other subsidiaries of COM007.

Market: European

Turnover (1994): Not known

COM010

Focus: Specialisation in the design and manufacture of packaging, predominantly plastics. Recent diversification is the development of 2 recycling plants in the UK.

Size/Position: 501+ employees. Main UK producer of light plastics packaging - now part of global group based in the USA.

Design employees: number not known - but policy is to have trained designers.

Market: European

Turnover (1994): £1-20m

CON001

Focus: Large architectural design consultancy. In-house environmental unit advises on all design decisions. Main focus is retail and leisure design.

Size/Position: 75 employees.

Design Employees: majority of total employees are designers, of these the majority are professionally trained.

Market: UK

Turnover (1994): £1-20m

CON002

Focus: Specialises in leisure and entertainment refurbishment.

Size/Position: 1-10 employees. Small interior design consultancy

Design employees: approx. 10 staff, most are professionally trained. MD is also a partner.

Market: UK

Turnover (1994): £100-500k

CON003

Focus: Graphics and communications - the majority of work is the design of reports for companies, councils, projects.

Size/Position: Small graphics design consultancy <10 employees

Design employees: 1-10, all are professionally trained

Market: UK

Turnover (1994): £1-20m

CON004 (Postal reply only)

Focus: Engineering and product focus. Wide variety of projects undertaken.

Size/Position: 1-10 employees

Design employees: 1-10, all are professionally trained

Market: UK

Turnover (1994): £100-500k

CON005

Focus: On communications and predominantly plastic packaging.

Size/Position: 1-10 employees - Small graphics and packaging consultancy.

Design employees: 1-10, all are professionally trained.

Market: UK

Turnover (1994): £500k-1m

CON006

Focus: This consultancy specialises in graphics communications and packaging.

Size/Position: 11- 50 employees. Originally London based, now split into 2 consultancies. *Design employees:* All designers are professionally trained, <10 employees

Market: global

Turnover (1994): £500k-1m

CON007

Focus: Product, predominantly an engineering bias. Wide range of experience gained over many years.

Size/Position: 'Two man band'

Design employees: 2 are professionally trained (engineers)

Market: UK & Europe

Turnover (1994): <£100k

CON008

Focus: Wide product focus but particular expertise in furniture, luggage and lighting systems.

Size/Position: 1-10 employees, an established product design consultancy.

Design employees: All are professionally trained, <10 employees

Market: predominately UK

Turnover (1994): £100-500k

CON009

Focus: Main focus is on family owned retail businesses - expertise in refurbishment design.

Size/Position: 'One man band' interior design consultancy.

Design employees: 1 trained interior designer

Market: UK

Turnover (1994): £100-500k

CON010

Focus: Domestic product focus but covers a wide range of products. They have won many design awards.

Size/Position: 1-10 employees - well established but fairly small consultancy.

Design employees: All are professionally trained, <10 employees

Market: global

Turnover (1994): £100-500k

CON011

Focus: Product design consultancy - Domestic product focus - ranges from telecommunications to kettles. They have won a have a number of design awards.

Size/Position: Part of international group although group originated from London office. < 20 employees in this consultancy.

Design employees: 1-10 (in this office). All are professionally trained

Market: global

Turnover (1994): £1-20m

The companies were significantly larger in terms of the number of employees than all but one of the design consultancies. The number of employees of a company was taken as the number in the relevant division when there was more than one division. Although the consultancies had fewer employees, the number of design staff of both groups were about the same with the majority of design staff having a professional design qualification. The markets for the companies tended to be European and global whereas the consultancies tended to focus on the UK market. This may bear some relation to the fact that in many cases environmental initiatives were spurred on in companies due to the environmental requirements for products and packaging intended for export to countries like Germany.

5.8 Semi-Structured interview themes

Questions were devised in a questionnaire format, but it is important to stress that they were used more as a guide to interviewing as opposed to a formal interview structure. The questions were divided into three sections, namely :-

- background information
- design information
- environmental information.

Questions were covered in a similar order in each interview but if the respondent was providing useful information that led on to another relevant area, then that area would be covered at that time. In this way the interview proceeded more like a discussion than a 'rigid' interview and this approach produced a lot of valuable information that would have been lost by rigid adherence to preconceived questions on a questionnaire. A summary of the main questions within each section are as follows.

The questionnaire is reproduced in Appendix 1C

5.8.1 Background Information

- When was the company founded?
- What is the status of the company?
- Does the company have a R&D / Design department
- Could you describe the main company business ~ in terms of its products and its markets.
- Could you tell me what percentage of your product sales is exported?
- What are the main countries for export markets?
- Could you tell me the most recent approximate value (£000) of total turnover for this company / division as listed in your most recent annual report?

5.8.2 The Design Process

- *Important to get real 'ecodesign' examples (visual if possible) Might be better to try and focus down on one or two product examples in this section - to get a story from those involved....*
- What forms of internal or external pressures are there for incorporating an environmental perspective in product design and development?
- The ways in which the development of new products or redesign of existing ones has been affected by environmental pressure on the company.
- Could we begin by taking each stage of the design process for product X and seeing where changes needed to take place in order to accommodate environmental pressures.
- How does this product's development differ at various stages of the design process from a comparative non-green product that hasn't been influenced by environmental concerns?

- What barriers / opportunities are there for the introduction of environmental criteria into the design process?
- To date what environmental impacts have been considered in the development of product X?
- Have there been attempts to assess environmental impacts of the product over the whole life cycle?
- Is new or different information required for environmental issues to be addressed within the product development process?
- Is information needed at different stages of the design process?
- Is information needed to tackle different approaches to green design?
- Has there been a change in the product development process, as a result of environmental pressures, resulted in increased collaboration with customers, suppliers and competitors?
- How successful has the greener product you have described been?
- Do you consider that environmental issues will restrict the creativity of the designer at any stages of the product development process?
- Do environmental issues provide opportunity for designers to exercise greater creativity at any stage of product development?
- Some people say that the design of 'greener' products is a short term answer to dealing with a passing green trend. What is your reaction to this?
- What are the implications of greener products for manufacturing processes, methods of marketing etc.?
- Do environmental factors challenge the ethos of design as we currently know it? (quantity vs. quality; market-led vs. longer life...)
- Do you feel that designers can play an important role in reducing the environmental impacts of products?

- What is the best 'greener' product(s) of the type(s) you have described and who makes it (them)?
- Who do you consider to be the environmental benchmark companies involved in design and development in your own or in other industries?
For what reasons do you think this?

5.8.3 Environmental Policy

- Does your company have an environmental policy?
Is this a written formal policy or an informal policy?
i)Please describe the main objectives of this policy.
ii)What are the reasons for your company implementing an environmental policy?
- Which sections of the environmental policy are of particular relevance to this department / division?
- Who in the company / division / department is (would be) accountable for ensuring that these policies are successfully implemented?
- What operations within this department need to be re-addressed with environmental issues in mind?
- Does the company environmental policy or other pressures to tackle environmental issues give rise to a need for environmental education and training in the company.
If YES - Is an environmental training programme practised / being considered in this department / division? What does / will this entail?
If NO -Why?
- Have employees within this department / division brought about changes in practices that were 'environmentally risqué' by placing pressure on management?
What were these changes?
What was the company's reaction to this?
Is this encouraged within the workplace?

The main research findings arising from these interviews are discussed in Chapter Six.

ECODESIGN

Chapter 6

An Analysis of the Main Research Findings

" I think in terms of designers being on the whole, liberalists - then they'll all be flying a flag for the environment like all the other causes I think there is that awareness. The best thing you can do is start from small things, and you know, if you can follow that through as much as you can - I mean, no one can change the world can they but you can do your own little bit I suppose."

Manchester based design consultancy (Author's interview, 1995)

6.1 Introduction

The aim of this chapter is to present the findings of the main research study. The revised research design, research criteria and company and consultancy descriptions for this section of the research programme are discussed in Chapter Five; the following is a summary of the main points:

The pilot surveys indicated that there was a degree of environmental awareness amongst designers in some sectors of UK manufacturing industry and among designers in the design consultancy industry. However, very little of this interest in environmental issues has so far been translated into action. As a result of these findings the original research design method has evolved; in preference to analysing best practice in design-based companies, through in-depth interviews and participant observation, the focus has altered to obtain an overview of 'better' practice companies, focusing on in-depth interviews across a broader sample. Due to problems regarding access to companies the concept of 'participant observation' became unrealistic and thus the main research consisted of in-depth interviews in a larger number of companies which were supported by secondary information such as company reports and presentations and further conversations with relevant personnel.

The aims of the main study are to provide information on how designers in industry can design in a more environmentally responsible way. Areas such as the information needs of designers, the management of design and the communication within the company and throughout the supply chain are of particular interest in this study.

A description of each company and design consultancy interviewed and the questions covered in these interviews can be found in Chapter Five. For reference, the questionnaire has been reproduced in Appendix 1C.

6.2 Analysis of the transcript data

All but two of the interviews in the main study were tape-recorded with full transcripts being made. The result of this process was the production of a vast amount of information from the transcripts and interview notes. In order to obtain as accurate and as reliable information as possible, the analysis was split into three stages:

STAGE 1. An initial overview of the results presented in a 'matrix' form;

STAGE 2. The development of an 'environmental footprint' for each company and consultancy;

STAGE 3. An analysis of the main themes emerging from the transcripts and interview notes.

In the first stage of analysis the initial overview of the main research findings is presented in two matrices, one for environmental information and one for design information.

Background information is presented as an introduction in order to give the reader a brief summary of the size and the business nature of each company and consultancy.

The matrices are designed to present the questions and corresponding responses of each interviewee; responses are discussed briefly under question headings before the analysis moves to the second stage, the environmental footprints. Here the environmental attitude and action of companies and consultancies regarding design, management and company philosophy are presented in a visual manner; degrees of company environmental attitude and action emerge in the form of different footprint images which are grouped into 'types of footprint'.

The final stage focuses in greater depth on the transcripts. The research findings are supported by direct quotes from those interviewed which helps contextualize the responses and provides an understanding of the opportunities and barriers to incorporating an environmental perspective within design and development.

6.3 Initial indications from the in-depth interviews obtained from a matrix overview

6.3.1 Business Information

The business information of each of the companies and consultancies involved in the main study has been compiled in order for the reader to gain an understanding of the size, market background and design interest of the interview sample. The following is an overview of the company /consultancy summary presented in Chapter Five, section 5.7.4

The companies were overwhelmingly larger than all but one of the design consultancies, which is not surprising as design consultancies do usually tend to be small businesses. The number of employees of a company was taken as the number employed in the relevant division when there was more than one division. Although the design consultancies tended to be smaller in overall size than the companies, the number of design employees was similar across both consultancies and companies; most firms employed between one and ten design staff, the majority of whom had a professional design qualification. The companies interviewed focused exclusively on product based design; two of these companies did however incorporate an element of graphic design as they also designed the packaging for their products. In the design consultancy sample a number of areas of design were represented. 47% of consultancies focused on product design, 27% on graphic design and the remaining percentage on architectural and interior design. Product design was therefore the main design area across the whole interview sample.

The markets for the companies tended to be European and global, whereas the consultancies tended to focus on the UK market - this may bare some relationship to the fact that in many cases environmental initiatives were spurred on in companies due to the environmental criteria for products and packaging for export to countries like Germany. The companies, being larger, tended to have a higher annual turnover than the design consultancies. The size of the business is an important factor to take into account here where the smaller company (for example, the design consultancy) would not be expected to earn as much as a larger company - who in many cases, was part of a national or global parent group.

Although the business sectors are quite diverse there seems to be little difference between sectors on the degree of environmental action. The similarities within sectors occur from the perspective of similar environmental factors impacting on certain product groups - for example, in the area of furniture, the timber resource issue was common and in computer manufacture issues such as energy efficiency and VDU health and safety factors arose. There were however, similarities between the way, for example, a larger company in the information technology field incorporated environmental standards compared to one of similar size in the plastics packaging sector - the overwhelming differentiating factor

seemed to be the ‘size’ of the company. Analysis indicates that the integration of environmental issues in design and development are to do with the overall management strategy of the company and are not necessarily directly linked to design and development philosophies or processes; a point which is discussed later on in this chapter.

6.3.2 Environmental Information

The basic responses to the questions asked in the environmental section of the in-depth interview questionnaire are collated and presented in Table 6.1. By viewing the data in this way it is possible to gain an immediate profile of each respondent company and consultancy and thus obtain a fairly accurate overview of the level of environmental awareness and action of the interview sample group. Although the transcripts had been read and coded by this stage of the analysis, much of the information presented in Table 6.1 is taken from interview notes and responses noted on the questionnaires; the main reason for this was to ascertain, in the least complicated way possible, an impression of the responses as a whole. This matrix analysis also applies to the section on design where an initial overview of responses is presented in Table 6.2.

Matrix of Environmental Responses

Questions

company code	business area	do you have an enviro. policy	is it an informal/ formal enviro. policy	awareness of the main aims of policy	is the policy relevant to R&D/ design	is there enviro. account-ability	enviro. account-ability at what level	what are the main drivers for having an enviro. policy	is there a need for enviro. training	does an enviro. training programme exist	are there examples of employee enviro. initiatives
COM001	IT (telecommunications)	yes	formal	no	yes	yes	divisional	legn. market	no	not planned	no
COM002	commercial refrigeration	yes	formal	yes	yes	yes	divisional	legn.	yes	imminent	no
COM003	DIY tools	yes	not sure	no	don't know	don't know	don't know	don't know	don't know	don't know	don't know
COM004	IT (monitors)	yes	formal	no	yes	yes	dept. - group	legn., corporate image	yes	existing	no
COM005	reproduction furniture	yes	formal	yes	yes	yes	division-group	cost. corporate image	yes	existing	yes
COM006	IT (telecommunications)	yes	formal	no	no	yes	divisional	corporate image	no	not planned	yes
COM007	IT (servers/ PC's)	yes	formal	yes	yes	yes	division-group	cost. corporate image	yes	existing	yes
COM008	Office furniture	yes	formal	no	yes	yes	dept. & division	legn., market, other	yes	not planned	no
COM009	IT (refurbishment / separation)	yes	formal	no	don't know	yes	divisional	legn., market, cost	don't know	don't know	yes
COM010	plastic packs. / recycling	yes	formal	yes	yes	yes	division & group	legn., corporate image	yes	existing	yes
CON001	architecture (retail)	yes	formal	yes	yes	yes	consultancy	corporate image	yes	existing	no
CON002	graphics (entertainment)	no	N/A	N/A	N/A	N/A	N/A	legn.	-	-	-
CON003	graphics (communications/reports)	no	informal	no formal aims	-	-	-	legn.	yes	not planned	yes
CON004	product (engineering)	no	N/A	N/A	N/A	N/A	N/A	-	-	-	-
CON005	graphics (communication s/packaging)	no	informal	no formal aims	-	-	-	cost	no	not planned	no
CON006	graphics (communication s/ packaging)	yes	informal	yes	-	-	-	legn.	no	not planned	no
CON007	product (engineering)	no	informal	no formal aims	-	-	-	legn., other	-	-	-
CON008	product (luggage / furniture)	no	informal	no formal aims	-	-	-	legn., corporate image	yes	not planned	yes
CON009	interior (retail)	no	informal	no formal aims	-	-	-	-	-	-	-
CON010	product (domestic appliances)	yes	informal	yes	no	no	-	market, corporate image	yes	not planned	no
CON011	product (domestic appliances)	yes	informal	yes	no	no	-	legn.	yes	not planned	no

Table 6.1

6.3.2 (a) Formulating an Environmental Policy

With the exception of one consultancy, an architecture group, there was not one formal environmental policy amongst the sample of consultancies interviewed. Many explained that the consultancy culture does not operate by means of formal policies but depends on a more informal, spoken approach (this may have something to do with the smaller size of these businesses - generally under 10 employees). All 'informal' environmental policies were presented as 'an awareness' of the issues. The policy tended to be extremely loose and no designer could expand further on the concept of 'awareness' to indicate a comprehensive understanding of environmental issues and illustrate the consultancy's objectives in this area.

The one consultancy that had implemented a formal environmental policy was much larger and its structure resembled that of a company - it included its own environmental unit which specified all the environmental decisions for the company and therefore none of the designers needed to have specific knowledge in the environmental area as this resource was on hand. The head of the environmental unit was interviewed for this study and was the only interviewee of the design consultancy sector not to be a practising designer. This undoubtedly had an affect on the responses given to the questions and explains why this particular consultancy appears very favourably in its environmental awareness to other consultancies in the sample. Even so, it must be noted that this consultancy was the only one to be interviewed that had an internal environmental unit which was actively responding to both internal and external environmental concerns.

All the companies stated that they had a formal, written environmental statement, but surprisingly few interviewees could illustrate what the main points of this policy were and how it related to the research and development department. Comments such as, *'it exists .. I think, we're a large company, I'm sure we'd have something like this ..'* occurred frequently.

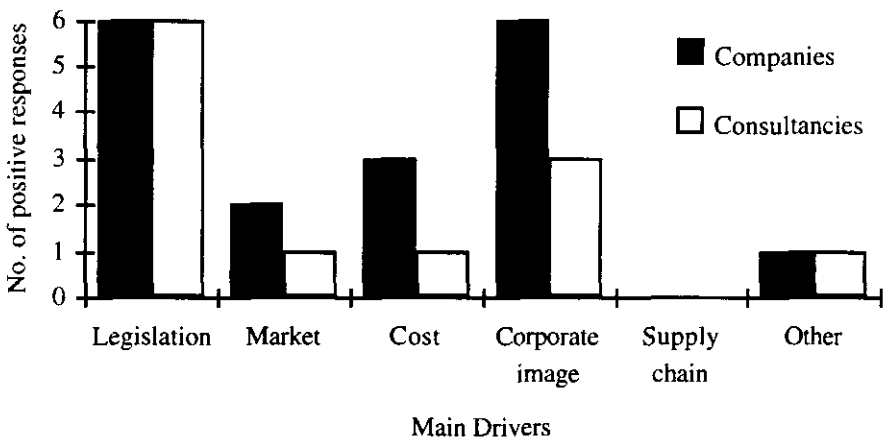
The two companies (COM007 & COM010) who could describe their environmental policies in relation to design and development were again (as in the consultancy sector) those companies whose environmental officers were the interviewees. In both companies the design and development work tends to be contracted out to subsidiary companies or it is mostly done by the parent company abroad; it was therefore very difficult to arrange an interview with design personnel. This must be taken into account when acknowledging the more 'environmentally active' stance of these companies, compared to others in the company sample, in the analysis of the results.

Accountability for the implementation of a formal environmental policy was generally at a divisional level who then reported back to the company head of environmental issues - in a few cases this information would then be passed down to those concerned at the group level. Whether this process actually happened in practice was difficult to ascertain. In at least one case there was strong evidence to suggest that the company management had

circulated a memo. to design and development staff regarding design for the environment initiatives but this had not be followed up by any further guidance, information or training; at the time of the interview the respondents could not even remember the content of the message.

Many of the companies interviewed had publicised their environmental policies as a part of their company reports. However, due to the lack of awareness of these environmental initiatives by design and development personnel it seems evident that in many cases, there is a problem regarding effective communication within company structures.

6.3.2 (b) Drivers for incorporating an environmental policy / perspective



Note: Interviewees could give a number of positive responses

Figure 6.1

For both companies and consultancies legislation was seen as the main driver for incorporating an environmental perspective within company practice (Figure 6.1). In the case of the company responses, equally important was the company’s ‘corporate image’; this was not characteristic of any specific business sector. One architectural and two product design consultancies rated corporate image as the second most important driver for incorporating an environmental perspective within business practice. Cost and market drivers impacted more on the company sector than the consultancy sector, with the latter group having one positive response from a graphics consultancy to cost drivers and one positive response to market drivers from a product design consultancy. Supply chain drivers were not directly acknowledged by any of the respondents. However these pressures did appear in the transcripts and are discussed in later chapters; for example, the issue regarding ‘sensitive timber’ sourcing meant that a company had to acknowledge and deal with environmental pressures from the raw material end of the supply chain. Both groups acknowledged ‘other’ drivers; a product consultancy mentioned ‘politically’ driven action and a furniture company thought that new manufacturing processes had an

important impact on a company's ability to incorporate environmental criteria within their business practices.

6.3.2 (c) Environmental training needs

More companies than consultancies replied to this question as consultancies tended not to see its relevance; the issue is again one of company size and how smaller companies (design consultancies) operate in comparison to the medium and large companies. The general difference between company and consultancy attitudes to environmental issues was that the companies had formalised their approach whereas consultancies had continued to operate in an 'ad-hoc' manner.

Of those respondents who replied to the question concerning the need for environmental training, both the companies and consultancies considered there to be a need for formal environmental training for employees. Four companies and the architectural design consultancy already had an existing environmental training programme and another company had a training programme that was due to be launched. The other six design consultancies and three companies who had replied positively to the need for environmental training commented on the fact that no such programme was currently planned in any of their businesses.

Employee environmental initiatives were acknowledged more from company respondents than from respondents in design consultancies. Environmental initiatives that were mentioned were generally in the realms of broad good housekeeping; issues such as waste and energy conservation were central to employee action.

6.3.3 Design Information

The initial analysis of design responses from the questionnaire is presented in Table 6.2. The following section describes these results.

Matrix of Design Responses

Questions

company code	business area	main drivers in considering enviro. issues	examples of eco-design	changes in the design process due to enviro. issues	changes are where in the design process due to enviro. issues	barriers / opportunities for change in design	enviro. impacts considered to date <i>see code</i>	enviro. impact analysis used	new info. required for effective eco-design <i>see code</i>	info. required in which areas of enviro. design <i>see code</i>	new info. at which stage in design process	does enviro. criteria have an affect on creativity	enviro. impacts can be reduced by design	enviro. principles challenge current ethos of design	does considering enviro. criteria = increased collaboration in supply chain	position of business regarding enviro. issues
COM001	IT (telecommunications)	cost	yes	no	N/A	barriers	4,7	no	yes	not sure	through-out	enhance	yes	don't know	customer	there are no leaders
COM002	commercial refrigeration	legn.	yes	yes	brief design	don't know	1,2,9	no	yes	1,2,9	through-out	enhance	yes	no	supplier, customer	the leader
COM003	DIY tools	legn., cost, suppliers / customers	yes	yes	through-out process	barriers	1,2,4,5,8,9	no	yes	1,4,5,9	through-out	enhance	yes	yes	supplier, customer	the leader
COM004	IT (monitors)	legn., cost, own philosophy	yes	no	N/A	barriers	1,2,5,8,9	yes	yes	not sure	not sure	enhance	yes	don't know	supplier	the leader
COM005	reproduction furniture	own philosophy	yes	no	N/A	barriers / opportunities	1,4,5,6,9	no	yes	research	brief design	no change	yes	yes	supplier	the leader
COM006	IT (telecommunications)	cost	yes	yes	brief design & concept	barriers / opportunities	4,5,8	no	yes	5	brief design	enhance	yes	yes	supplier, customer	not sure
COM007	IT (servers/PC's)	standards, own philosophy, technology	yes	don't know	N/A	barriers / opportunities	1,4,5,7,8	no	yes	5,7,8	not sure	enhance	yes	yes	supplier, customer	one of the leaders
COM008	Office furniture	suppliers / customers	yes	yes	brief design & concept	barriers / opportunities	1,4,5,7,8,9	no	yes	not sure	through-out	enhance	yes	yes	supplier	there are no leaders
COM009	IT (refurbishment / separation)	legn., market, cost	no	don't know	N/A	opportunities	7,8	don't know	yes	5,7,8,9	not sure	don't know	yes	don't know	supplier, customer	the leader
COM010	plastic packs / recycling	legn., cost, own philosophy	yes	don't know	N/A	don't know	1,4,5,8,9	yes	yes	5	not sure	enhance	yes	don't know	supplier, customer	the leader
CON001	architecture (retail)	legn., own philosophy	yes	yes	brief design	barriers / opportunities	all	yes	yes	1,2,5,8,9	brief design & concept	enhance	yes	yes	supplier, customer competitor	the leader
CON002	graphics (entertainment)	legn., cost, suppliers / customers	no	don't know	N/A	barriers / opportunities	1,5,7	no	don't know	N/A	N/A	enhance	no	no	supplier	there are no leaders
CON003	graphics (communications/reports)	all <i>(see group A)</i>	yes	no	N/A	barriers	4,	no	yes	5	not sure	no change	yes	not sure	supplier	there are no leaders
CON004	product (engineering)	all <i>(see group A)</i>	no	don't know	N/A	don't know	4,9	no	yes	all areas	brief design, concept & manuf.	no change	no	no	don't know	not a leader
CON005	graphics (communication s/packaging)	legn., cost	no	yes	brief design	barriers / opportunities	1,2,4,5,8	no	yes	all areas	brief design & concept	enhance	yes	not sure	don't know	not sure
CON006	graphics (communication s/ packaging)	legn., standards	no	no	N/A	opportunities	4,5,8,9	no	don't know	5,9	N/A	enhance	no	yes	supplier	not a leader
CON007	product (engineering)	legn., suppliers / customers	no	no	N/A	barriers / opportunities	don't know	no	no	N/A	N/A	enhance	yes	no	don't know	not a leader
CON008	product (luggage / furniture)	legn., own philosophy	no	yes	brief design	barriers / opportunities	5,9	no	yes	all areas	5	no change	no	yes	supplier, customer	not a leader
CON009	interior (retail)	market, standards	no	no	N/A	barriers	1,6	no	yes	1,4,7	5	enhance	yes	no	supplier	not a leader
CON010	product (domestic appliances)	legn., cost, suppliers / customers	no	no	N/A	don't know	5	yes	yes	not sure	5	enhance	yes	yes	don't know	not a leader
CON011	product (domestic appliances)	legn., cost, suppliers / customers	yes	yes	brief design & concept	barriers / opportunities	1,2,5,7,9	no	yes	all areas	5	enhance	yes	no	supplier, customer	not a leader

Table 6.2

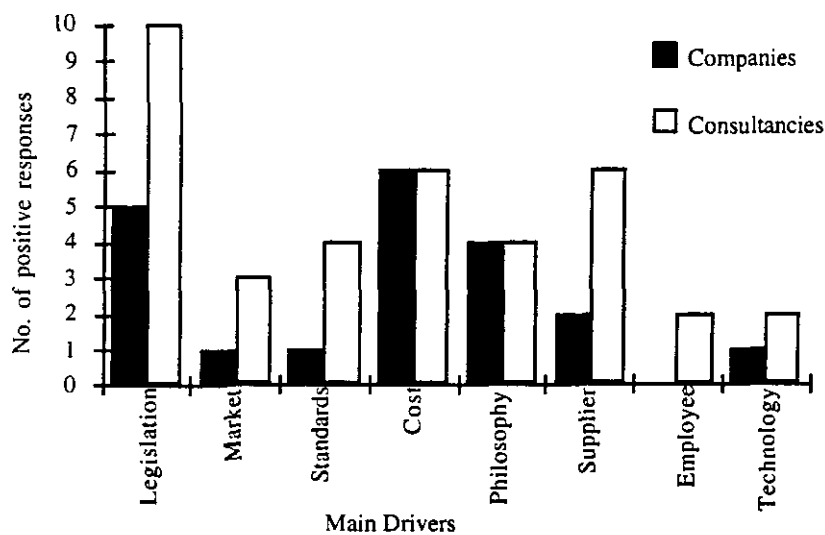
Code

energy efficiency - 1
energy conservation - 2
renewable energy source - 3
reduction in material usage - 4
recycled materials - 5
renewable materials - 6
design for durability, repair & maintenance - 8
reduced use / elimination of toxic / hazardous materials-9

Group A

legislation
market
cost
standards
company philosophy
suppliers / customers
employee pressure
technology

6.3.3 (a) Main Drivers for Considering Environmental Issues in the Design Process



Note: Each interviewee can make more than one response. Figure 6.2

Neither business sector nor company size played a role in distinguishing which drivers were deemed important for implementing an environmental perspective within the design process.

Nearly all consultancies felt that legislation was an important influencing factor whereas only half of the companies interviewed believed this to be the case. Cost was the second most influential driver - in this context the reference is generally to material minimisation, reducing waste and pollution and energy efficiency, i.e. good housekeeping. Consultancies identified the client in influencing the incorporation of environmental criteria within the design brief. Clients were often given as a reason as to why these issues could not be incorporated within design projects which took the responsibility for environmental action out of the design consultants' hands.

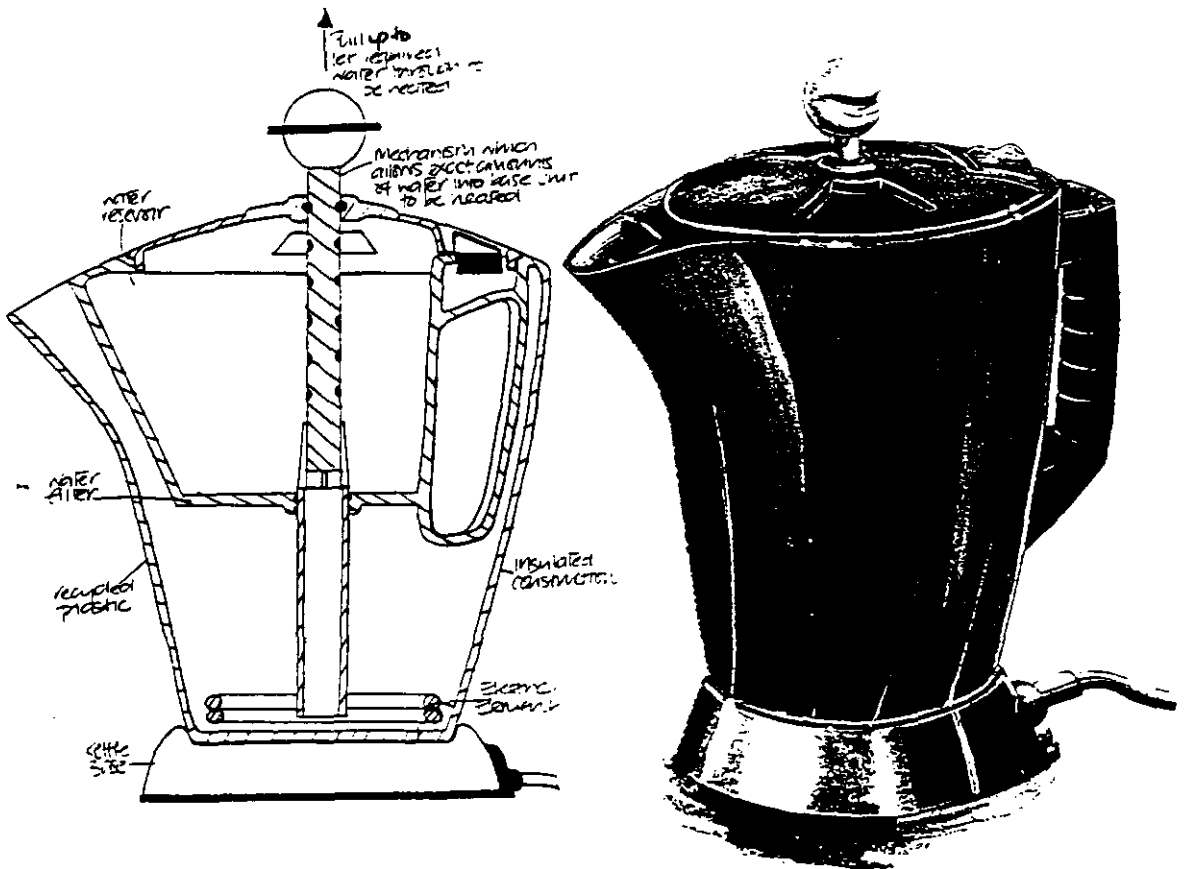
Both groups of designers felt that corporate philosophy was an important driver. Market pressure or sensitivity of the market to environmental issues was mentioned primarily by consultancies as a driver for change. Respondents from consultancies also mentioned supplier and employee pressure and standards/ regulations as drivers for environmentally responsible design; very few company respondents mentioned these. Finally, two consultancies and one company thought that technology may be a main driver for encouraging an environmentally positive change in design processes.

6.3.3 (b) Existing examples of EcoDesign.

Although many of the designers in the companies interviewed said that they did have examples of 'ecodesign' work, it was often not the case. Their definition of ecodesign included incremental changes to the product or the product packaging. In some cases not even this had been the case - often the design project had been loosely associated to the 'environment' as an issue, examples of this being the design of an environmental report or the choosing of a new material or packaging process solely for cost reasons which subsequently is found to be slightly more environmentally benign. For example, COM004 had produced a glossy designed environmental report for the company which they talked about as an example of 'ecodesign' and COM003 talked about their product packaging as being 'green', when there had been no change in the packaging design, because it suited the market to do so.

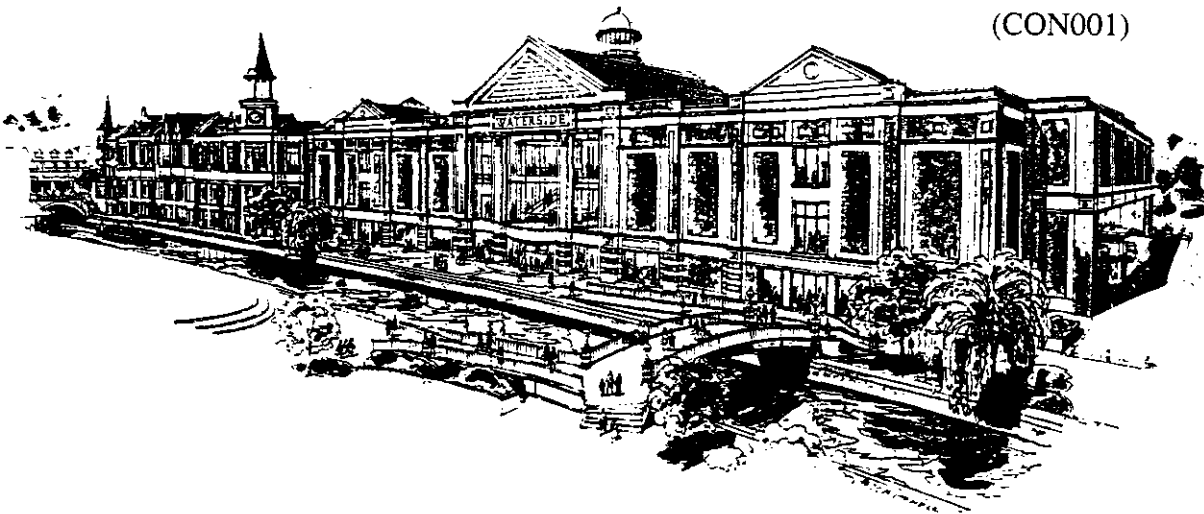
Two examples of good environmentally sensitive design came from consultancies 001 and 011. The latter had entered a green kettle into a competition and it has subsequently been widely used to illustrate ecodesign thinking. (Figure 6.3).

Figure 6.3: A rendering and cross section (text added) of the 'green' kettle developed by CON011



CON001 had implemented an environmental assessment plan for all design projects undertaken by the consultancy and gave an interesting presentation of two examples of their work. One of these, a large shopping complex, had won many design awards and commendations and the consultancy had used it, as a representative example of their work, to develop a methodology that allowed an objective assessment of a building's environmental impact while establishing a basis for the identification of alternatives that would provide improved environmental performance. (Figure 6.4 and Table 6.3).

“The existing confusion surrounding the acceptability of certain environmental standards, the numerous unsubstantiated claims continuously being made in the name of the environment and, finally, the desire to open the way to a consensus approach towards responsible development planning, instead of the usual confrontational attitude, did all encourage us to embark on this study. Our objective was to uncover those felt to be key issues and to offer all relevant parties involved in the planning, design and development of town centre shopping schemes, a common basis for discussion that will hopefully ease the difficulties so often found during the planning process. We attempted to do so by utilising one of our own pieces of work to re-examine the whole planning and decision-making process and to identify the areas for future improvement.”



(CON001)

Figure 6.4: The Waterside Shopping Centre

Factor	Presence	Degree	Assessment	Score Range	Final Score
Environmental Assessment	Yes	Formal	Very Good	4	
			Good	3	
			Satisfactory	2	
			Poor	1	
			Very Poor	0	
	No, but	Appraisal	Very Good	4	
			Good	3	
			Satisfactory	2	
			Poor	1	
			Very Poor	0	
	No			0	0
Consideration of Alternatives and selection of final option taking into account likely environmental effects.	Yes	Fully		5	2
	No	Partially		2	
				0	
Need for the Development			Very High	4	2
			High	3	
			Moderate	2	
			Low	1	
			None (0)	0	
Public Involvement	Yes	Consultation		3	1
	No	Information		0	

Table 6.3: Part of the rating matrix developed to analyse the environmental impacts of the Waterside centre.

Company 006 had focused on design for disassembly and had designed a telephone to be quickly assembled and disassembled taking into account material compatibility, plastics marking, and ease of joining component parts; the result of this exercise was a telephone that required only four screws to hold it together compared to their main competitor's, produced in the Far East, that required eleven screws. The result was a dramatic time and cost saving in the assembly and disassembly processes of the 'four screw' telephone, the establishment of a disassembly centre and the subsequent increased refurbishment and secondary use and recycling of existing telephones.

6.3.3 (c) Changes in the design process as a result of incorporating environmental criteria

There was a mixed response to the question of whether or not the design process would change as a result of incorporating environmental criteria into design and development. Of those who responded, half thought that there would be some sort of change, while the others felt that the environment would be just like another criteria and therefore there would be no change. Those that responded positively suggested that generally the change would occur in the initial stages of the design process where a greater degree of time would need to be allocated for research into 'unknown territory'; the concept stage of the design process was therefore highlighted as the most likely component of the design process to change due to an increased focus on environmental issues. However, the point was also made that with increased familiarity with the relevant environmental issues and new information, the extra time originally needed at the concept design stage would eventually no longer be necessary.

The focus on the initial stages of the design process is an interesting one. The concept of design time versus design impact has been established for some time; in the 1980's the DTI advertised the benefits of introducing design into business by stating that the first 20% of design effort (and therefore design costs) resulted in 80% of the overall impact that design had. The majority of design decisions are made in the initial 20% of design intervention; these decisions have an impact throughout the whole of a product's life. This concept is therefore extremely applicable to environmentally responsible design (McAloone 1996) where design decisions made at the design brief and design concept stages of the design process have direct impacts on a product at, for example, the disposal end of its life, i.e., can the product be reused?; is it easily refurbished?; can it be efficiently disassembled?; are the component materials compatible?

Many saw that there would be both barriers and opportunities for implementing an environmental perspective within design depending on business area, market acceptance, company attitude, customer attitude, cost and legislation. These factors are discussed in greater depth in the analysis of the transcripts from these interviews. One general point which was made repeatedly by the interviewees was the requirement of an even playing field so that all companies were starting from an equal position. This element of an

unwillingness to take risks is echoed throughout the majority of the interviews. It supports the view (Hinnells 1994, Green & McMeekin 1995) that perhaps a regulatory approach is the only feasible way to 'encourage' firms to adopt more environmentally responsible design and development processes where the 'individual commercial risk' element is eliminated from the equation.

An example of 'commercial risk' associated with introducing more environmentally benign product design philosophies into company practice is illustrated by COM006's case; here the company had lost sales to its Far East competitor who could produce product at less cost. However the main client in the UK (to which both COM006 and the Far East competitor supplied the same product) had encouraged COM006 to look at assembly and disassembly costs of this product. COM006 had invested time and money into dramatically reducing assembly and disassembly costs of this product to encourage reuse, refurbishment and recycling at the end of first life. The main client however, favoured the cheaper product unit from the Far East which did not take into account these end-of-life criteria. Understandably, COM006 were not, at the time of interview, happy with this result!

6.3.3 (d) Information requirements for implementing effective ecodesign strategies

Designers in companies felt overwhelmingly that there was a need for new information in order to effectively carry out more ecodesign oriented projects. All but two of the consultancies agreed with this. Again it was the initial stages of the design process that required the greatest influx of information, as it was perceived that most of the design decisions are formulated at this stage. However most designers felt that information throughout the process would be relevant as there would be a need for more knowledge on new manufacturing/assembly/disassembly processes.

6.3.3 (e) The Creativity Factor: does the potential for creativity increase or decrease as a result of incorporating environmental design criteria within the design brief?

Almost all designers, irrespective of business sector or company size, felt that environmental criteria would give the designer a greater challenge and would therefore encourage greater creativity - as design individuals and as design teams. A small number considered that the environment would just be another factor and therefore there should be no change in the levels of creativity of the designer or design team. With reference to the development of environmentally responsible new products, Dermody (1995) states that,

"radical thinking and creative ideas will be required to help overcome the limitations, omissions and reliability of environmental information, particularly information relating to environmental impact."

6.3.3 (f) The role of design and the designer in ‘greening’ product development

Many of the respondents thought that designers could play an important role in reducing environmental impacts. However many also mentioned the limitations of the designer within the design process. These included the need for discussion between managers and designers on design briefs before they are referred to the design department and the need for greater cross-fertilisation of ideas between the client and the designer in order that new opportunities can be recognised. Surprisingly, a large proportion of the designers interviewed indicated that for many of the design projects they undertake, the design brief is basically decided before it is even handed to them. One might presume that the design decision process is taking place at a management level within the company or client. Although the purpose of a design brief is to provide instructions for designers, many designers felt that the brief was now so detailed that there was little scope for flexibility. For example, regarding the introduction of new, more environmentally benign materials, one company could not introduce a recycled content within its product, not for structural or manufacturing reasons but because of the colour requirements from the client’s marketing department. A compromise was reached - the designers managed to persuade the client to use some recycled content in the internal mouldings of the product.

More than half of the those that responded felt that the meaning, or ‘ethos’, of design might change from how it is currently seen, due to the increasing concern over environmental problems and the integration of environmental criteria within a design and development context. The ‘environment’ as an issue might challenge current thinking in design to move away from a style and market-led profession of ‘hardware deliverables’ towards a new level of design that concentrates on service, or the software interface between new technologies and human understanding. Some interviewees indicated that this was already happening to a degree; for example, in the commercial furniture sector, manufacturers were moving toward concepts of designing ‘space’ rather than trying to sell furniture. The demand is moving away from the hard product towards the service of providing comfort, flexibility and reducing space requirement in office environments. This is an important point and is addressed at the final analysis stage in this chapter.

6.3.3 (g) Does collaboration between the different parties in the supply chain increase where there is a greater emphasis is placed on environmental impacts?

Only one of the respondents felt that there had been an increase in collaboration with suppliers, customers and competitors because of integrating environmental requirements within their business practice. There was generally a move to increased collaboration with suppliers, particularly from a material resource perspective - many of the interviewees felt they were becoming increasingly reliant on their suppliers to provide accurate environmental information for their materials. This was more relevant to design projects

involving the use of timber where ‘sensitive’ materials could pass through the net into the supply stream. At the present time companies have to rely on the validation of the supplier as to where the timber originates and so many companies have passed the responsibility down the supply chain. Therefore the supplier is fully responsible if the timber is not validated accurately and a problem arises. At present there is no global scheme for marking timbers to ensure that they are not sourced from environmentally sensitive areas. This also applies to man-made wood materials such as chipboard; the old Eastern block export chipboard to the West but unfortunately, chipboard from these sources generally does not meet UK health and safety standards because of the hazardous adhesives used in its construction - again, there is no recognised validating system for these materials.

There was some indication that there had also been an increase in collaboration between the company and its customers. In some case the larger retailers had specified to their suppliers (including some of the companies in the sample) a set of environmental criteria to meet in order that they would qualify to continue to supply that retailer. In some cases help / information had been forthcoming from the retailer, while in other cases the company had to meet the criteria on their own.

6.3.3 (h) Environmental leaders in the different business sectors

With the exception of the architectural consultancy none of the design consultancies felt that they were leaders in the area of environmentally responsible design; in fact two consultancies thought that there were no leaders at all in this area. However, the architectural consultancy thought that they were the leader in this area within the UK architectural consultancy sector.

In comparison, 70% of the company sample thought that they were leaders in environmentally responsible design within their particular industry sectors. 20% of companies felt that there were no leaders and 10% did not know whether there were leaders or not.

6.3.4 In-depth interview results: an initial overview of the analysis matrixes

- It seems that the designers in companies operate on a more formal level than their counterparts in design consultancies; in the companies the approach revolves around written business policies whereas design consultancies adopt an informal, spoken business approach.
- It is apparent that, even though a formal, written environmental policy might be adopted by the company, it does not necessarily equate with the transference of environmental aims and objectives within the organisation at all levels. This has been illustrated in a number of the companies interviewed where the management have developed a number of environmental design stewardship goals but these have not be

communicated effectively to members of design and development teams within the company - to the extent in some cases, where there is no knowledge in the design team of these environmental design goals (For example, COM001, COM003, COM004, COM008)

- Many of the drivers for incorporating environmental criteria within the design and development process are for either reactive reasons such as legislation or market demands, or cost saving, (good housekeeping among these).
- Further environmental information is required for effective environmental design decisions to be made at the initial stages of the design process so that the continuation of environmentally sound practice occurs throughout all aspects of the design, development and manufacturing processes, so that disposal decisions might be considered at the design stage.
- Many design briefs are near completion on arrival in the design department. It would seem that many of the initial design decisions, which effect the main environmental impacts of a product, are being formulated by non-design personnel.
- The majority of respondents felt that designers had an important role to play in reducing the environmental impacts of their design projects.

6.4 ‘Environmental Footprints’

For this research project, it was felt important to further analyse the attitudes and action of respondents. Secondary information from company reports and consultancy literature was used, where appropriate, to support, confirm and contrast information gathered from the interviews. A visual method, the ‘environmental footprint’, seemed the most useful way of comparing and contrasting information between both the companies and consultancies. The initial analysis of the transcripts and interview notes highlighted four areas to focus on within these organisations:-

- Vision
- Action
- Communication
- Design Process

Within each of these areas there are a number of issues or ‘themes’. These themes are labelled on the environmental footprint and are discussed in turn in the following section.

6.4.1 Vision

This area relates to the company or consultancy philosophy. It addresses concepts of business planning, business management, the level of environmental awareness, the

direction of environmental action and the way the future of the company is viewed. For example, those companies or consultancies that tended to be relatively 'cynical' in the way they viewed environmental issues, tended also to be fairly short-term in their outlook on product development, tended to have a very centralised management unit from which design briefs originated and tended to concentrate on one or maybe two environmental issues in product development. These issues were often high profile media issues such as packaging or minimising process pollution, and may or may not have given rise to the greatest environmental impacts of a company's products.

6.4.2 Action

This area addresses the level of environmental action of a company or consultancy. Themes such as what were the main drivers for taking environmental action? Were these planned and pro-active initiatives or forced upon the business as a reaction to external demands? Was the action comprehensive and applicable in the areas it addressed or less focused and uninformed, resulting in 'ad-hoc' action within the business? The main research study sample was composed of businesses with a variety of different environmental action approaches (see environmental footprint - a cynical approach; a reactive approach; a proactive approach). For example, the majority of companies seemed to have taken a rather reactive environmental action stance in the projects they had undertaken to date; many of these respondents had introduced environmental criteria into the design and development process because of legislative and customer demands or cost reasons. An architectural design consultancy was the only consultancy interviewed to have an internally driven environmental action strategy that focused on the design's life-cycle. This consultancy had developed an environmental design checklist system to apply to all of its designs (as detailed on p. 148). It had also used this system to analyse environmental decisions made in previous design projects in order to ascertain how accurate their original environmental predictions and decisions had been. The management had seen a need for this type of environmental analysis in the future and had therefore decided to apply this high level of environmental analysis in all their designs in order to establish themselves in this area.

Four other companies were beginning to think in a longer-term way regarding environmental design, but all of them had future legislative goals in mind; the two IT companies were focusing on take-back legislation and the logistics of closing the material loop; this was also the case for the telecommunications company. A packaging company had established a recycling facility as part of the company structure because of future legislation specifying an increase in the proportion of recycled content within packaging; they recognised the financial benefits of having their own recycling facility for their own packaging and also as a material resource for other packaging manufacturers (their competitors), even though the pay-back period was much longer than most companies would expect - the reason given for this was that the company was still privately owned

and therefore had more 'financial freedom' in the projects it chose to back (i.e., not being responsible to public shareholders).

Within some of the companies and consultancies interviewed, environmental action was a result of individual 'environmental champions' within the workplace. Such action was often publicised by the organisation in a way that indicated that the action was a result of a comprehensive effort on behalf of the company to be 'more green'. An example of this was the integration of recycled plastic within the computer keyboards of an IT company. The company environmental report illustrated this example as company environmental action as a result of product stewardship initiatives. In fact it had been a result of an observation by an employee on the plastic waste produced in the production of the computer keyboards. He suggested that this 'pre-consumer' waste was collected, re-ground into plastic pellets and incorporated back into the production process. This initiative saved the company tonnes of plastic per year and is therefore more to do with 'good housekeeping' than proactive environmental product stewardship. Other examples include the technical director of a furniture company encouraging the company to help financially support, and therefore help manage, an area of rainforest in South America. This initiative encouraged the company to undertake an environmental audit of its business practice and production processes and helped them win a national environmental award. In the design consultancy sample, an enthusiastic designer had developed a number of green product concepts which he entered into a Green Design competition. A green kettle (detailed on p.147) was highly commended and 'the consultancy' won recognition for their work in this area - the designer helped to raise the profile of environmental issues within the consultancy and within UK design practice.

6.4.3 Communication

This is an important area which crosses all boundaries in a company structure. The main study responses focused on communication as a central area. Directly related themes are:

- the effective implementation of environmental policy - whether written or spoken;
- the management of information within the company or consultancy (does the company have an 'open' philosophy regarding transparency of information?);
- the need for the communication of new and complex information within design and development processes - has the appropriate information been made available, are there on-going training seminars for management, designers, engineers, process technicians etc.?

The gap between what is perceived to be happening from an environmental perspective and what is actually happening in terms of environmental action (with a focus on design and development practice) has been identified in the company sample a major problem. For example, within a global company group, an environmental policy focusing on product stewardship might be devised in the headquarters in America, but by the time these goals

have been transferred ‘down the line’ to a company division, say in Glasgow, the emphasis and direction has often been lost and the implementation of these environmental design goals is unlikely.

6.4.4 Process

The ‘process’ relates to the design and development process and the environmental issues associated with this. Themes emerging from the design and development process questions include changes in the process; opportunities or barriers for including environmental perspective within the design process; concepts of creativity - does the inclusion of environmental criteria create more of a challenge for the designer and thus is there an increased potential for designer creativity?

Information is also a process theme, it is important for the effective implementation of more environmentally responsible designs. However, this has already been addressed and is more relevant to the ‘communication’ section and so will not be found under ‘process’ in the footprint chart.

6.4.5 Ranking environmental attitude and action: the environmental footprint template

The areas of vision, action, communication and process and their associated themes were established from the transcript texts. They are represented in the environmental footprint shown in Figure 6.5. The characteristics of each company and consultancy were plotted on the environmental footprint and various patterns of environmental ‘attitude and action’ have emerged from this exercise. The ‘footprint’ concept has been used to effectively show what the main areas are for environmental action (or in-action) from the whole interview sample. Levels of environmental awareness and action can be illustrated by the use of a ranking system; each arm of the environmental footprint has a ranking scale of zero to five on which the information from the transcripts is plotted (shown below) - this enables an impression of the environmental awareness and action of each company and consultancy to be formed. A ranking of zero translates as ‘very little environmental awareness or action compared to a ranking of five which suggests an internally driven, more pro-active environmental attitude (see diagram below). A score is given to each theme on the footprint for each company and consultancy in the sample and thus a picture of the company or consultancy stance on environmental issues develops.

Very little awareness & action		External factors for action		Internal pressures to adopt enviro. philosophy	
0	1	2	3	4	5
No adoption of eco-design philosophies		Reactive approach to incorporating ecodesign		Very pro-active approach to incorporating ecodesign	

The environmental footprint template

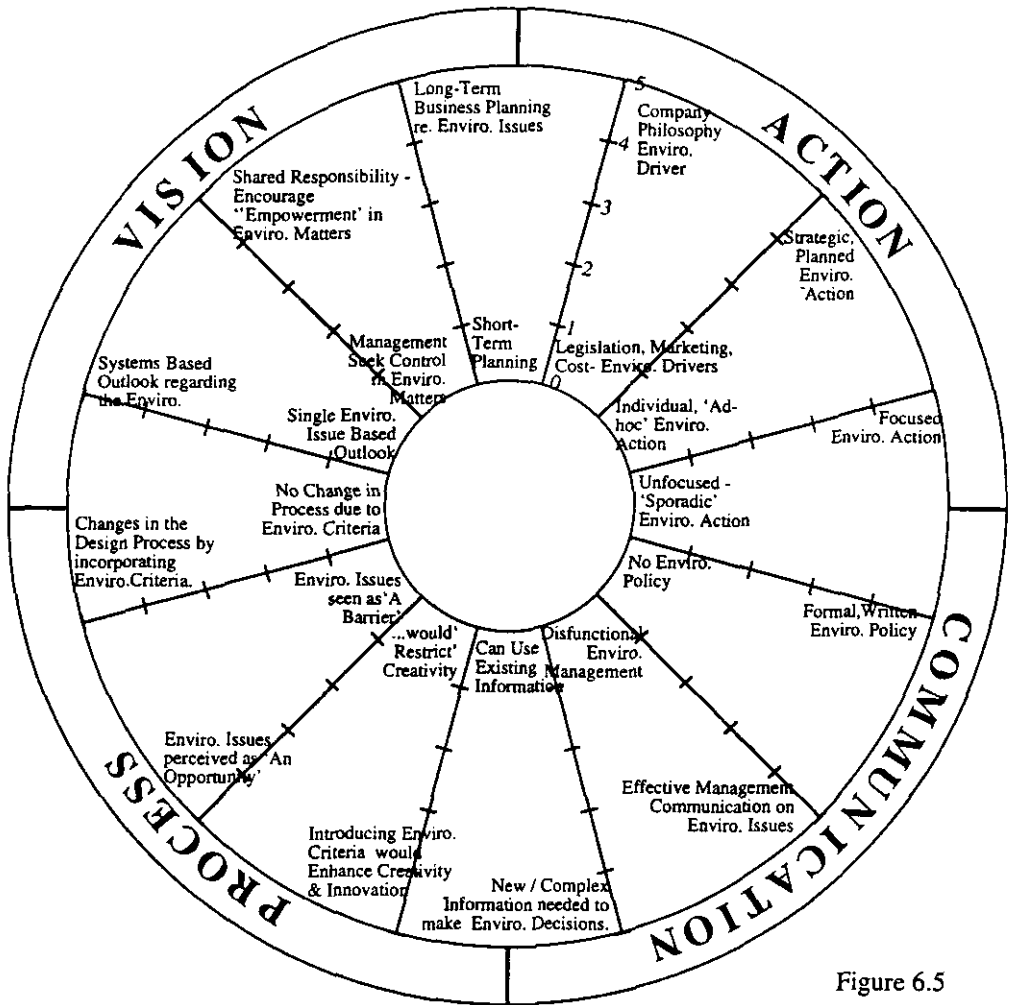


Figure 6.5

A visual analysis such as the 'footprint' has been utilised elsewhere by PA Consultants in developing an overview of a product's lifecycle (Seeney 1995), and by Van Hemel (Delft 1995) in comparing the environmental impacts of a product incorporating environmental criteria with the same product with no environmental criteria placed upon it. Polar charts and star diagrams are other approaches used to graphically analyse complex data, as are mapping systems and spider diagrams which can be used to visually represent and analyse different scenarios (Nijkamp et al. 1995).

6.4.6 Environmental footprint profiles

The results of the footprint analysis group the different approaches to incorporating an environmental perspective within a business. By plotting data in this way it could be seen that there were certain 'visual' characteristics for particular environmental action-oriented organisations. These characteristics have been grouped into three core 'types' as follows:-

- the 'cynical' company
- the 'reactive' company
- the 'environmental pro-active' company.

The characteristic 'shapes' of these company types are shown in Figure. 6.2.

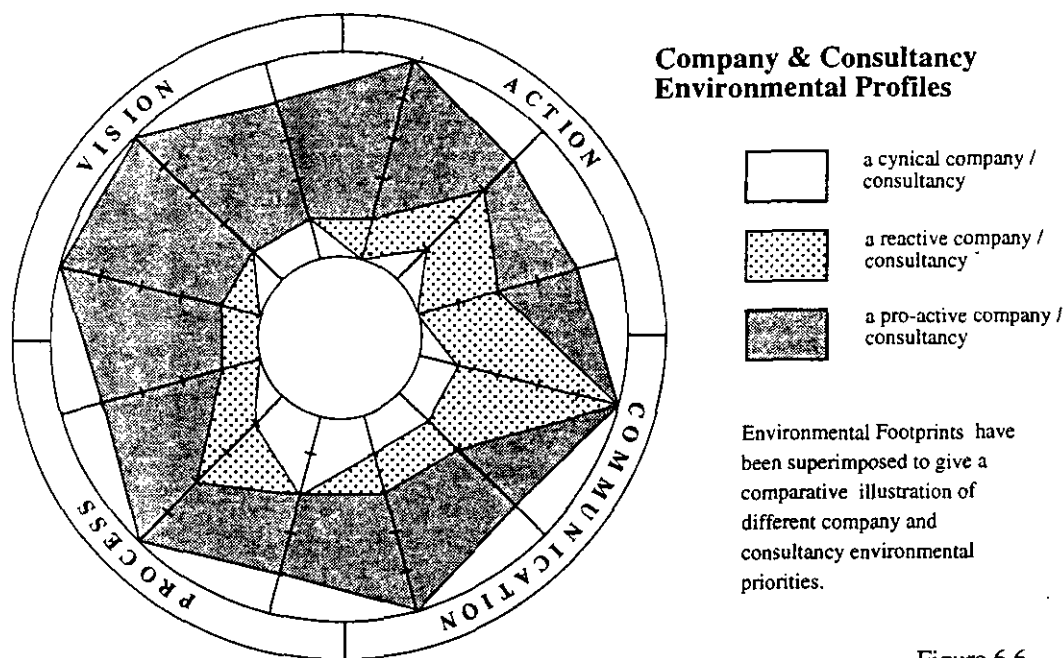


Figure 6.6

As Figure 6.6 illustrates, the three core types of company produce quite different environmental footprints. A company who is cynical about the incorporation of environmentally responsible design issues tends to produce a small footprint around the centre area. This demonstrates that the company has scored relatively poorly in the ranking scale achieving only a zero, one, or two level ranking on each theme arm of the footprint profile. A reactive company approach can be seen in a footprint that has a slightly larger profile than that of a cynical company. Often a reactive company will score a high ranking in the area of communication where they have a formal environmental policy. However, this often does not translate into a high ranking score in the action sector (reflecting the gap between policy and practice). Also, the themes within the 'vision sector' of the footprint often have very low ranking scores; for example, this demonstrates where environmental initiatives have been a result of reacting towards market forces or legislation and not as a result of an internally driven environmental philosophy. A pro-active company produces an environmental footprint whose profile is symmetrical and covers a large area; this indicates that the company has scored highly on all theme arms in the footprint and thus has a balanced and comprehensive attitude to incorporating environmental issues within design and development practice.

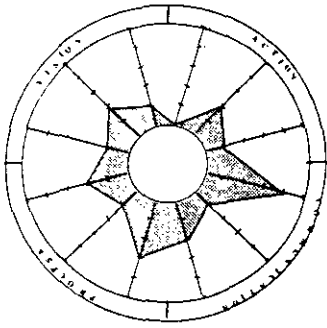
The 'type's' of profile shown above refer to the environmental attitude and action of a company or consultancy - they do not necessarily reflect other aspects of a company's or consultancy's method of managing their business although, in many cases, their approach towards environmental issues is a good indication of how other areas are managed within the organisation. The three types of environmental profile used to illustrate where the case

studies fit are by no means the only company or consultancy profile types. A typology of organisational types has been developed to show the range of environmental attitude and action from a design perspective - the design perspective is intrinsically linked to the process and the overall management systems and so gives a good indication of overall company philosophy. Further discussion on the development of this typology occurs in Chapter Seven, 7.6.

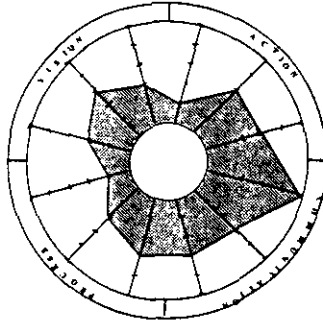
6.4.7 The environmental footprints of the company and consultancy samples

The environmental footprints for both the companies and consultancies are shown in Figures 6.7 and 6.8 respectively. These two figures illustrate the distinctions in environmental attitude and action within the company and design consultancy sample groups. For example, COM007's environmental footprint covers a large area and is quite symmetrical in shape. This company is moving towards that of a pro-active footprint profile. In contrast to this, COM003 has a very reactive environmental business approach; the footprint covers a smaller area, but with an emphasis towards the communication sector. The higher rank scoring in the communication sector of companies with a 'reactive' approach usually indicates the existence of an environmental policy - if a policy exists it is unlikely that it has been communicated down through the company as low score rankings are a feature of the action, vision and process areas of the profiles.

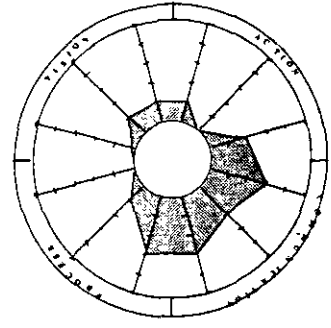
The majority of the consultancies' environmental profiles indicate both cynical and reactive business approaches. The exceptions are CON001 and CON011. The former has the most proactive environmental business approach of any of the companies or design consultancies while the latter is progressing towards a profile that indicates a comprehensive approach to environmental issues. Many of the design consultancies have higher ranking scores in the process and communication areas of the footprint rather than the vision and action areas. Themes in these areas include the information needs for designers, the perception of environmental issues on design and the concept of an increase in creativity because of new environmental criteria. The most probable explanation for the higher ranking scores on these themes is that designers are more familiar with issues directly related to the design process than with the other footprint areas of vision and action which tend to be the remit of the client rather than the consultancy (i.e., they tend to adopt a client's policy for each different design project and not impose their own philosophies on a client.)



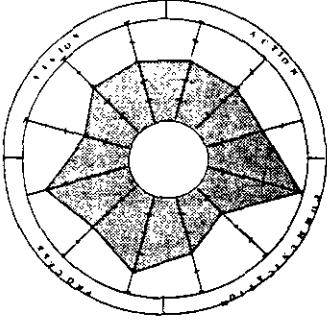
COM 001 I.T.



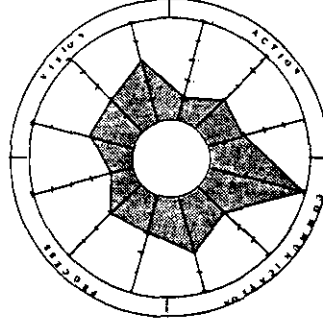
COM 002 WHITE GOODS



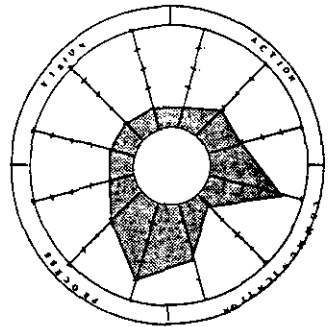
COM 003 D.I.Y.



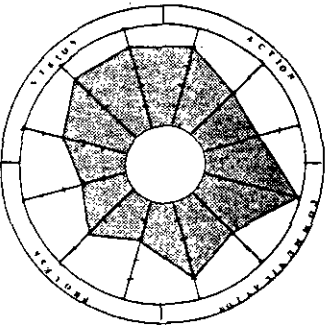
COM 004 I.T.



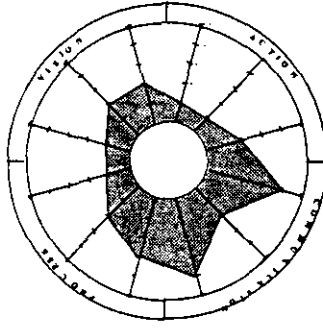
COM 005 FURNITURE



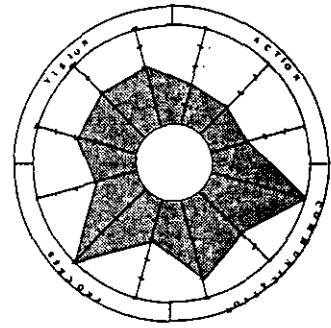
COM 006 TELECOMS



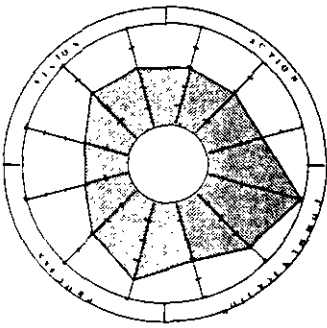
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COM 008 FURNITURE



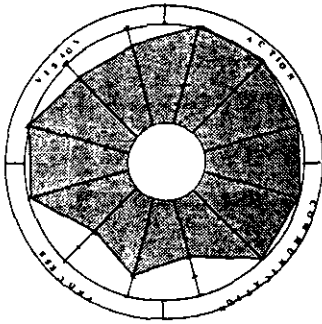
COM 009 I.T.



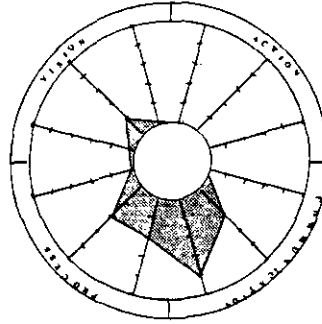
COM 010 PACKAGING

COMPANY ENVIRONMENTAL PROFILES

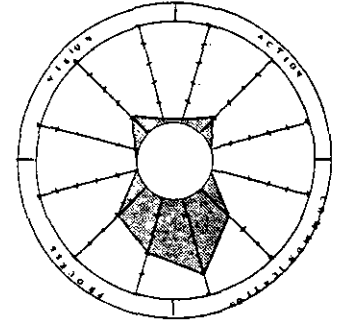
Figure 6.7



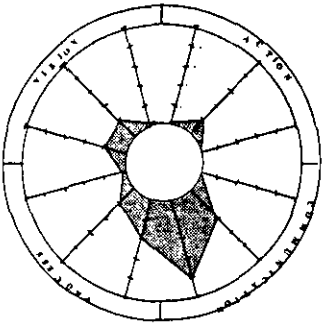
CON 001 ARCHITECTURE



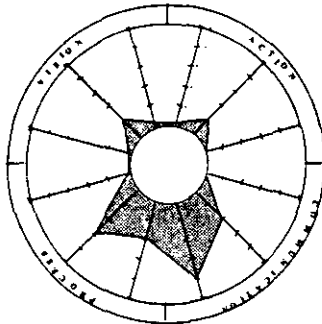
CON 002 INTERIOR



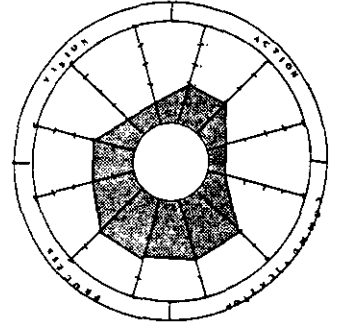
CON 003 GRAPHICS



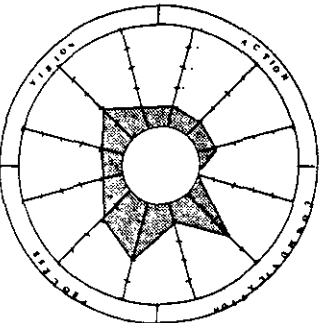
CON 004 PRODUCT



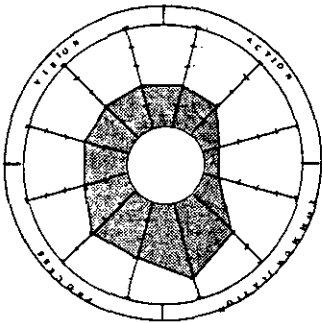
CON 005 PACKAGING &
GRAPHICS



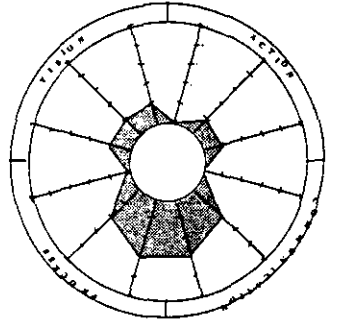
CON 006 PACKAGING &
GRAPHICS



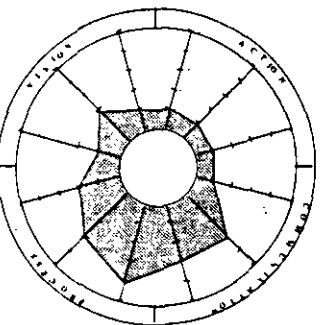
CON 007 PRODUCT



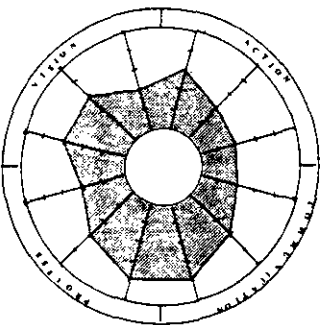
CON 008 PRODUCT



CON 009 INTERIOR



CON 010 PRODUCT



CON 011 PRODUCT

CONSULTANCY ENVIRONMENTAL PROFILES

Figure 6.8

6.5 Analysing the environmental footprints

In general the consultancies fall into the profile group of a 'cynical' approach towards integrating environmental issues within business practice. This is primarily because the majority of consultancies were very reactive towards incorporating environmental issues. This was either because they were themselves fairly cynical of the subject area or, more often, because they felt there was little they could achieve as individual consultancies where their client's interests and policies took precedent over their own. This was a very common reaction from the designers in all consultancy areas. The one obvious exception to this was the architectural design consultancy (CON001) who had implemented a highly comprehensive strategic system for managing environmental issues within the consultancy. Their environmental management system was complex and all encompassing and, this level, far exceeded anything produced in the company sample- even at the global company level. However, the relative small size of the consultancy might have an impact on the effectiveness of environmental policies as communication within the smaller organisation is easier to manage than in a large and more complex organisation.

In contrast, many of the company profiles indicated a recognition of the issues, but very few seemed to follow this through with a plan of action. Many of the companies, irrespective of industry sector, had taken environmental issues 'on board' in a half-hearted way. Some indicated that the sole purpose behind incorporating environmental criteria within design and development was to gain a commercial advantage within their market sector. Others admitted having a formal policy, but no subsequent action to back up the aims and objectives of the policy - one of the most common responses to this was the cost implications for implementing further initiatives.

In general the footprint illustrates the changing priorities within the sample and outlines each company's and consultancy's environmental stance from a design and management perspective.

A more in-depth analysis of the footprint characteristics is taken from the transcript data in the final analysis stage, 'Transcript Themes'. The barriers of implementing environmental strategies within design processes, the information required to do this and the results of doing this on the design process are among the topics discussed in this next section.

6.6 Transcript Themes

The analysis of these transcripts has been divided between the responses from the companies and the responses from the consultancies. The themes selected from the transcript material are identified in all of the interview transcripts and are as follows:-

- Attitudes
- Awareness
- Action
- Drivers
- Communication
- Design Process
- Information
- Market
- Technology

These themes relate to the areas focused on in the environmental footprints as follows:-

VISION	ACTION	COMMUNICATION	PROCESS
attitude	attitude	attitude	attitude
awareness	awareness	awareness	awareness
drivers	action	action	action
communication	communication	communication	communication
information	information	information	information
market	design process	design process	design process
technology	drivers	market	technology
	market		

Many of the themes from the transcripts are common to all areas of the environmental footprint. For example, a positive attitude towards incorporating environmental issues within business practice is imperative for the long-term vision of a company, for effective environmental action within the company, for direct and applicable communication within a company and between other members of the supply chain, and for the successful introduction of environmental criteria within design and development.

Each theme that emerged from the transcript analysis has been discussed separately and is accompanied by a ‘theme’ chart that illustrates the wide range of views from the respondents of the in-depth interviews. There are a number of different points of view represented in these theme charts, none of which are industry sector specific. Responses from interviewees have been ‘ranked’ in these charts to illustrate the respondent’s viewpoint on each theme. The ranking system for the transcript themes differs from the one used for the footprint analysis. Individual quotes have been used to illustrate a variety of opinions and in some cases this gives an impression of what the individuals would *like* to be doing, not necessarily what they *are* doing. The footprints illustrate more of an

overview of the actual company or consultancy perspective on environmental issues at the present time and in so doing might come across in a more ‘pessimistic’ manner than the more detailed and direct information presented in this section.

As a reference key for the charts, Table 6.4 is a reminder of the business information of each company and design consultancy interviewed for the main research study.

CODE	DESCRIPTION
Companies	
COM001	Research, design and development of primarily telecommunications equipment for the IT industry. Main group's focus is PC technology.
COM002	Research, design and development of commercial refrigeration units for the food industry - the biggest producers of this type of equipment in the UK. European holding group.
COM003	Research, design and development of DIY tools, primarily focusing on knives, blades and screwdrivers. One of the main UK companies in this field and hence market leader.
COM004	Large multinational IT company. This division is the European computer monitor research and development centre. It is also the base for the UK design team for this company.
COM005	Small division of UK furniture and upholstery manufacturers. Specialise in reproduction furniture manufacture and have won 2 environmental awards for design and for management.
COM006	Medium sized company based in S. Wales. Main supplier to main UK telecommunications company. Focus on the development and manufacture of telephones.
COM007	Large UK IT company now part of a multinational company, HQ in Japan. Company is umbrella for many smaller subsidiaries. Focus on the design and manufacture of PC and mainframe technologies. Also invested in take-back strategies to deal with used equipment.
COM008	Established UK furniture manufacture - originally set up by a furniture designer - strong design ethic. Now part of global group, HQ in the USA. Specialises in the design, development and manufacture of office furniture systems - main market is still the UK.
COM009	Originally subsidiary of 007 now an independent company but with strong ties to parent company. Specialisation is the refurbishment and separation of used IT equipment - setting up the logistics for effective take-back policies.
COM010	Main UK producer of light plastics packaging -now part of multinational based in the USA. Specialisation in the design and manufacture of predominantly plastics packaging. Recent diversification is the development of 2 recycling plants in the UK.
Consultancies	
CON001	Architectural design consultancy. In-house environmental unit advises on all design decisions - focal education point. Main focus is retail and leisure design.
CON002	Small interior design consultancy. MD is also a partner. Specialises in leisure and entertainment refurbishment's.
CON003	Small graphics design consultancy. Focuses on graphics and communications and the majority of work seems to be the design of reports for companies, councils, projects.
CON004	Engineering and product focus. Wide variety of projects undertaken. (Postal Reply)
CON005	Small graphics and packaging consultancy. Focus on communications and predominantly plastic packaging.
CON006	Originally London based, now split into 2 consultancies. This consultancy specialises in graphics communications and packaging.
CON007	Product focus, predominantly an engineering bias. Wide range of experience gained over many years. Market = UK & Europe.
CON008	Established product design consultancy. Wide product focus but particular expertise in furniture, luggage and lighting systems.
CON009	Small interior design consultancy. Main focus is on family owned retail businesses.
CON010	Product design, well established but fairly small consultancy. Domestic product focus but covers a wide range of products. Many design awards under their belt.
CON011	Product design consultancy - part of international group although group originated from London office. Domestic product focus - telecommunications - kettles. Have a number of design awards.

6.6.1 Attitudes towards the environment

The axis on the attitude theme chart (Figure 6.9) represents a range of perspectives from a cynical attitude to that of a proactive attitude to integrating environmental issues within design practice.

Many of the design consultants had a very 'laid back' attitude towards environmental issues. They all professed to having an interest in the subject, but some felt it was very much up to the larger organisations to take the lead and illustrate better practice by example. One interior design consultancy commented on the fact that a "national consciousness" on the environment had to be reached before anything could really be achieved and that legislation would be the main driver for enforcing change. The notable exception to an attitude of general apathy among the consultants was CON001 which is featured at the top of the theme chart. In the opinion of the interviewee concerned it was imperative to incorporate an environmental perspective within the consultancy's work in order to improve the quality of their design output.

Respondents from the company sector gave a number of mixed responses regarding attitude to environmental issues. Many of them mentioned the economic benefits of looking at environmental issues - for example, the savings made from good housekeeping practices and waste minimisation programmes. A couple of companies mentioned that they considered the 'hype' over the environment to be over and that it had now been overtaken by economic concerns.

Quality management was mentioned by COM007 as a framework in which to guide environmental thinking and action within the company. Companies tended to have a more global outlook on attitudes to the environment than their consultancy counterparts and this may well be due to the fact that the majority were part of a global organisation. A point raised regarding the 'global company' was the lack of communication between the different countries. For example, COM004 thought that the European division based in Germany was currently taking a lead in environmental issues but did not know any details about this - the fact that different countries also have different priorities may well effect *the transfer of environmental goals, information and guidance between these countries.*

Attitudes towards the environment

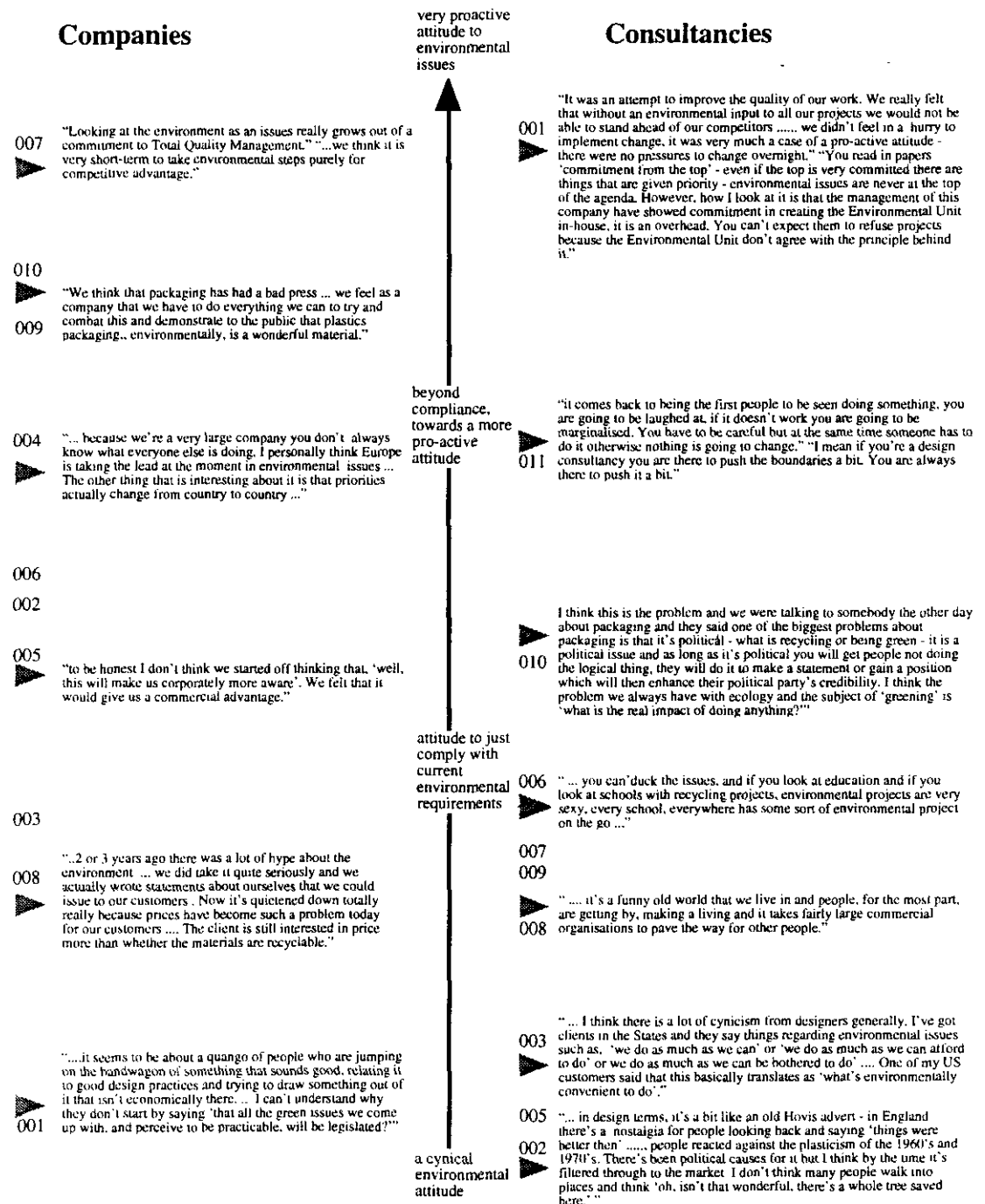


Figure 6.9

6.6.2 Awareness of environmental issues

In terms of an awareness of environmental issues the theme chart axis (Figure 6.10) focuses on whether respondents were aware of either an environmental policy related to design and development or, as in the case of the design consultants, were aware of 'general' environmental issues impacting on design and development.

As a general comment it would seem that designers in consultancies tended to express themselves as 'designers in general' rather than specifically focusing their answers on what their own consultancy was doing in this area. In contrast, the designers interviewed in companies normally related their responses to what was going on within their companies. The company responses highlighted issues within the industry sectors, for example in the IT industry recycling, take-back and disassembly were frequently mentioned. Furniture designers concentrated on resource issues and the market forces driving this. The respondent, an environmental manager, from a packaging company focused on EU legislation guidelines and the impact on the market. The head of design from a DIY company limited his focus to packaging as it had been an issue addressed by their main customer. All of his comments concerned with awareness of environmental issues revolved round the packaging debate. The senior designer in the refrigeration industry was most aware of the conflicting information regarding new chemicals as replacements for CFC's and HCFC's - he felt that it was becoming very difficult to specify in this area, as one could never be sure that legislation would not go against a company decision and hence result in a costly mistake by the company.

Within consultancies the concerns were not so area specific. Across the board it was felt that designers would be aware of environmental issues -more aware than accountants anyway - because designers were considered to have a "natural sympathy for their environment." They implied that designers were more sensitive than most individuals. Some felt that their 'awareness' was related to how interested their particular clients were in environmental issues and much of the legislative information for design briefs came through this channel.

In general the consultants tended to romanticise the environmental awareness issues, whereas designers in companies were firmly grounded in what was happening around them. For example, a design consultant talks about "*national consciousness level*", or "*nostalgia of the Hovis adverts*", whereas a company designer discusses EU policy, future restrictions on raw materials and targets for product recovery and recycling.

Awareness of environmental issues

Companies

Consultancies

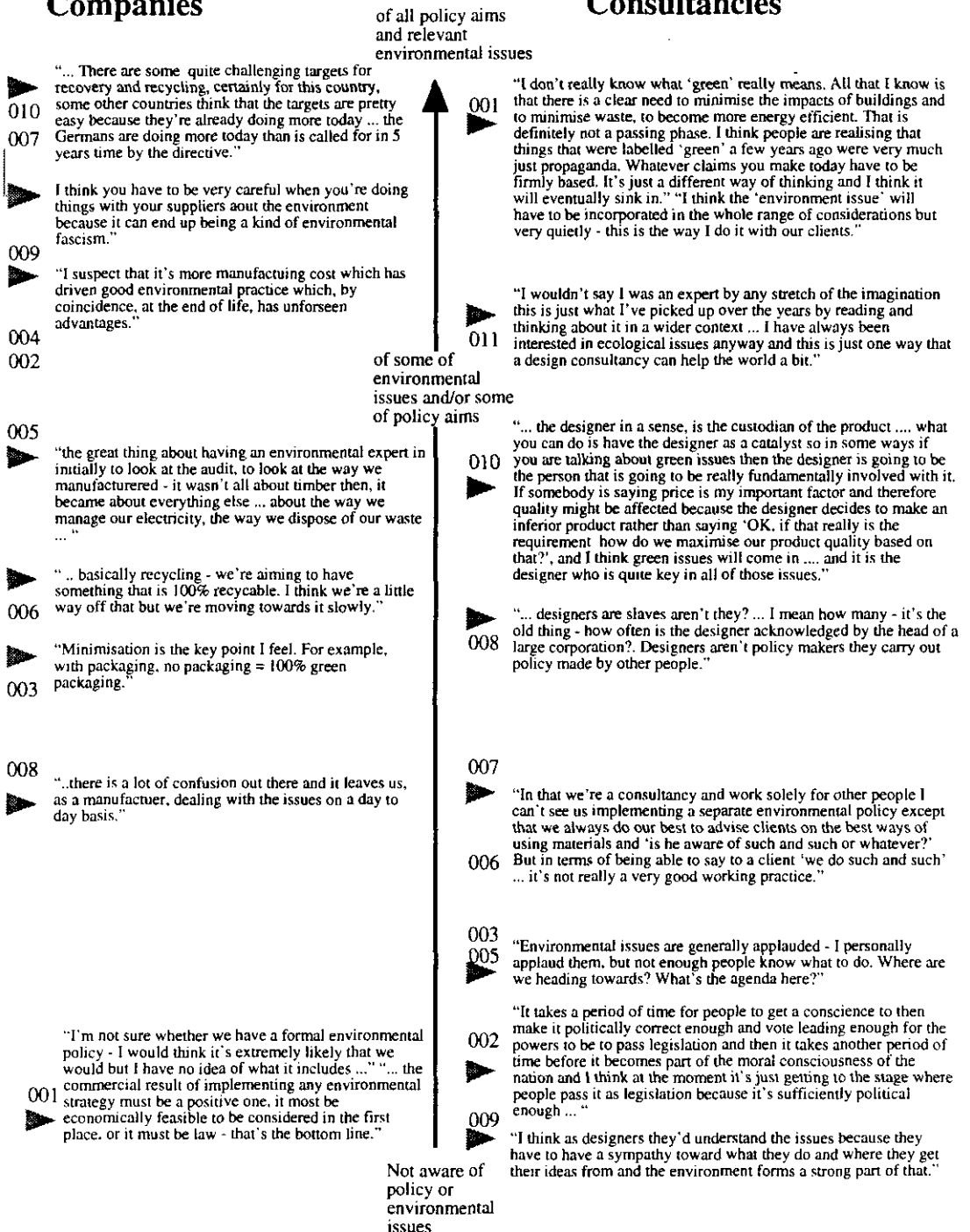


Figure 6.10

6.6.3 Action on environmental policies

The theme chart axis (Figure 6.11) represents a range of environmental action; it illustrates proactive environmental action at the top of the chart and 'ad-hoc', often reactive environmental action at the bottom of the chart.

All of the companies had prepared a formal environmental policy but the degree to which the aims of this were incorporated within the business practice varied greatly as is shown in the theme chart. COM007 had the most comprehensively managed policy, they had integrated their environmental objectives within the Total Quality Management structure already in place. In this way they felt that an environmental perspective would be included throughout the organisation at all levels; they were looking at a long-term approach to managing the environment. In contrast to this the majority of other companies seemed to feel that the 'environment' offered commercial potential to cut costs or launch 'new' products and that these were the main reasons for addressing these issues in the first place. In general companies were reacting to external drivers and thus designers were being forced to take account of environmental criteria in what seemed like a half-hearted manner - time to market was a key issues and the result of this was that designers had very little time to get to grips with a more comprehensive environmental agenda and the subsequent 'new' design information required to carrying out more long-term aims.

The consultancies did not have environmental policies, the exception being CON001 who had developed a long-term strategic environmental plan. The issues within consultancy practice are that the majority believe that environmental issues are 'out of their hands' - it was up to the clients to specify action within the design brief, they felt that they were in no position to take responsibility for the incorporation of environmental criteria and imposing this philosophy on their clients. In general they felt they could mention the issues, but would push the subject no further than that.

Action on environmental policies

Companies

Consultancies

Comprehensive,
strategically planned
environmental action

007 " ... we're a TQM company and we follow the European quality model which we've renamed the Strategic Quality Model (SQM). Within SQM there is a step called 'Impact on Society' which is rather more than the environment - it also includes how you react with your communities locally, regionally, nationally and internationally and we call these people 'step-holders' within the businesses we often use these people as a 'champion' for environmental and community action - there are a lot of different people networking." "...we're an empowered organisation - what we do here in our very small environmental affairs unit is monitor the progress in an unobtrusive way."

010 " ... the policy we brought out applies to this company but there is a knock-on effect to other divisions who are now adapting it for their on use." " ... we certainly see one of our roles to try and inform the public debate we also talk to our suppliers about these things as well because we don't think we can be green unless in turn our suppliers are doing things in the way in which we think they should be doing them."

009

005

004 " This company has always had a genuine concern about the environment - you only have to look at our approach to CFC elimination - we eliminated CFC's long before anybody else and took an initiative publicly to encourage other people to follow suit."

002

006 "I think the opportunity for us to do things that would be environmentally positive would be if a customer specified things a little more stringently so we were on a more even playing field and then we could say 'OK, it costs a penny more but it must be costing the Far East a penny more so we can do it.'"

003

001

001 "... the management decided to create an in-house Environmental Unit - they did this so that the job of the architects would be somehow complete or at least facilitated by having this sort of expertise in-house." "As far as projects are concerned we look at them at different stages:- strategic development stage, feasibility, building design and product specification, construction, post-construction. The first stage is probably of the greatest importance because we recognise here that our role at the other stages is very limited; we are recognising here the need for **strategic environmental assessment** but we can have very little influence at this stage."

010 "what we don't want to do is to produce products that are reckless, unnecessary and generally harmful to what we see as the environment - I suppose there is a sort of designer ethic that says that we are minimalists in a sense, that we tend to put things on where they're necessary for a product rather than just doing it rather than adding materials for the sake of adding materials."

011 "I think at least you have to make the client aware of it and just say you must be thinking about this and the position of government guidelines and environmental laws."

"We have internal structures governing everything - from our general relationships ... , but yeah, inevitably they have to be adaptable. We don't have someone who sits down and writes detailed guidelines on all these things although we do adopt principles of a number of working practices, like we try to be quite rigorous about that otherwise it would just be anarchy in any business ..."

006

"Environmental issues are not a problem it's just another thing to be taken into account. I don't really see them as being separate from anything else - just another criteria."

007

"well, I think this Sri Lankan student will join the consultancy because we are doing this Global Forum Report and I think it's quite nice to get other people when you're doing real projects to get their input."

003

005

009

002

"We'd say things like 'we assume you'll have low energy lighting in all the service areas .. is that correct? And that's part of what we always do.'"

'Ad-hoc' action -
generally reactive

Figure 6.11

6.6.4 Drivers for influencing environmental awareness and action

The driver theme chart (Figure 6.12) indicates whether the integration of environmental criteria within design and development practice occurred as a result of action to external pressures on the company (bottom of chart) or as a result of internal drives within the company to address environmental issues (top of the chart).

COM007 and CON001 were both implementing an environmental strategy because of their corporate philosophy to *integrate environmental issues within business practice*. Both of these businesses took the view that it was important to carry this out quietly and thoroughly. They felt that marketing this sort of approach was very short-term and was not appropriate action for a company that was tackling the issues wholeheartedly, and comprehensively.

COM10 and COM009 were both *integrating environmental issues into decision making* because of an internal drive to do so, but this had originally stemmed from pressure from a main supplier in one case and pressure from a previous parent company in the other. These two companies lie somewhere in-between an internal philosophy approach and the commercial driven approach of the majority of interviewees. The latter describes those companies that have either found they can achieve major cost savings through better environmental management or have marketed products, redesigned because of external environmental pressures - legislation, customer ...- as their own environmental philosophy to gain competitive advantage.

Cost, legislation and supplier/customer pressures were the main external drivers for the other companies and the majority of the consultancies, client pressure being key in the latter case.

Drivers for influencing environmental awareness and action

Companies

Consultancies

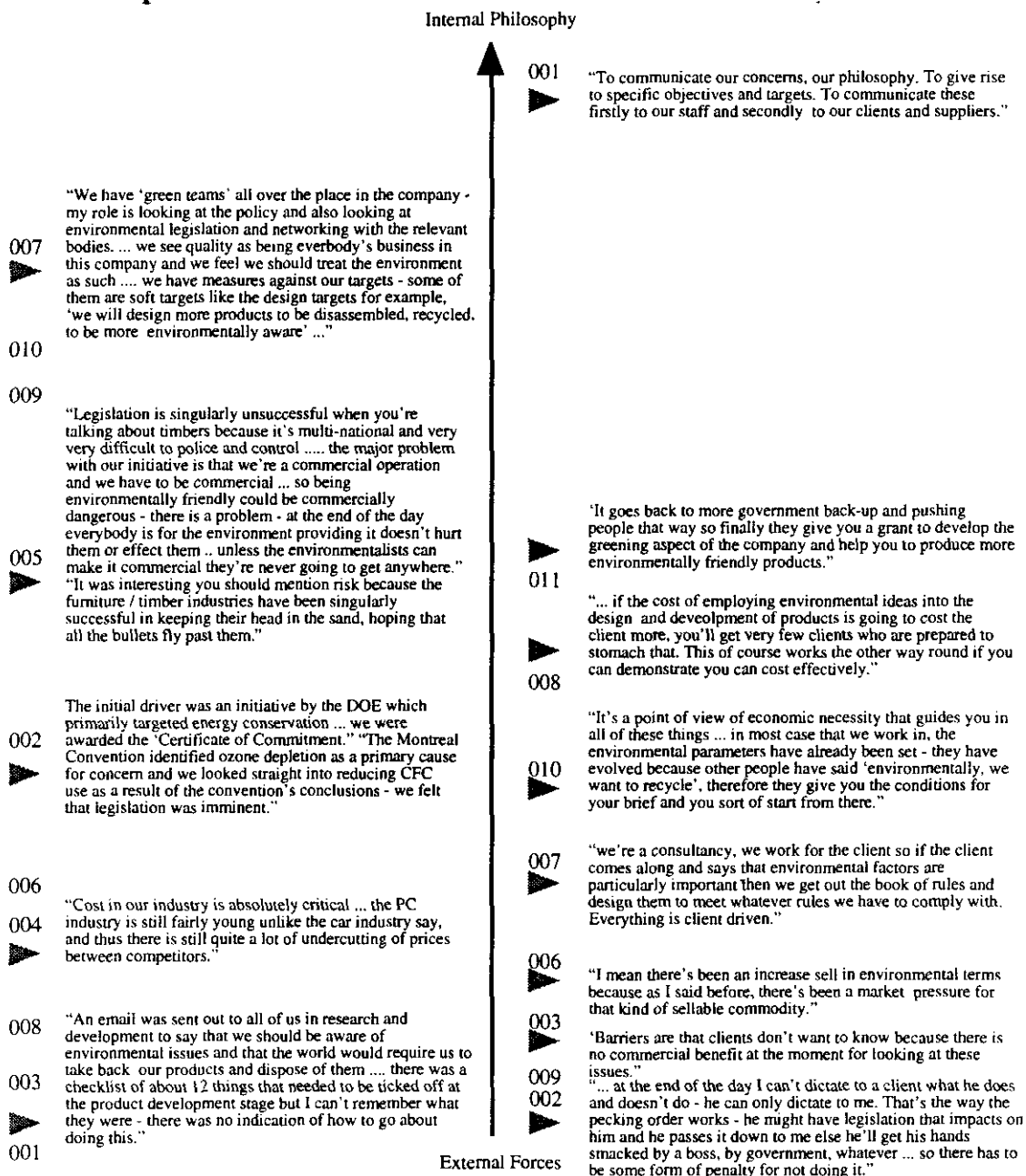


Figure 6.12

6.6.5 Communication of environmental issues

Communication within organisations has been highlighted as a major issue in the implementation of environmental policies. The communication theme chart (Figure 6.13) represents effective communication strategies at the top of the chart, and, at the lower end, describes cases where there has been little or no strategic communication; where if environmental action has occurred, it has been as a result of individual initiatives.

CON001, COM007 and COM010 all specified that it was vital for environmental awareness to be embedded within all levels of the organisation. In all cases action had either been taken, or was in the process of being taken, to ensure that the communication of their environmental policy and the environmental issues impacting on their business sectors, was effective. Training session, newsletters, transference of responsibility down the company were some of the ways in which a communication of the issues had been achieved. Communication within the supply chain was also an important area which was raised in a number of cases. For example, COM007 had realised the difficulty that their smaller suppliers had in keeping up with their environmental demands and had therefore included a support service for their suppliers which helped them work towards meeting the required environmental standards. COM007 pointed out that it was the responsibility of the larger organisation to communicate environmental information 'down the line'. If this doesn't happen then the supplier can get overwhelmed with the amount of new demands that need to be satisfied in order for their product, component, raw material etc., to be accepted.

'I think you have to be very careful when you're doing things with your suppliers about the environment because it can end up being a kind of environmental fascism, you know, trying to make them do certain things - we've developed a range of supplier questionnaires to try and avoid this problem.'
COM007 (1995)

Designers in consultancies tended to mention 'communication' in general rather than concentrating on communication within their consultancies; this was probably due to the fact that consultancies tend to be very small companies and therefore the communication within them is extremely informal.

The respondents from the design consultancy sector discussed the fact that a lot of the environmental information to date was confusing and too scientific and there was a growing need for clear simple messages that all people could relate to. Graphic designers also translated communication as the purpose of graphics per se and one of the most effective media for communication - they felt they should be utilised more to portray effective environmental messages.

Communication of environmental issues

Companies

Consultancies

Effective throughout organisation
and to suppliers / customers /
community

007 " ... we have just set up a user group - an environmental affairs forum - and we have got our third meeting of that group at the end of this week and a lot of people who attend these meetings are from Local Authorities and sometimes the larger corporations and government departments who are much more switched on to environmental issues." "We've got an accredited vendor (supplier) scheme - we included environmental actions in that vendor accreditation pack. We're working with our suppliers, especially our smaller suppliers, on taking environmental actions."

010 "one of my tasks within the company is to make sure everybody understands the various environmental imperatives that are coming along - those who are in charge of the next generation of our products as well as the future generations of our products and the future ways in which we run our factories - all are aware of what's coming along whether it's in terms of specific legislation or whether it's in terms of an attempt to bring in voluntary protocols or whether it's involved with public pressure"

005 "... the awareness is built now through the whole company ... all the managers fully understand the environmental policy and they wouldn't for instance, I don't buy the timber, obviously I oversee it because I'm responsible for the whole site but my mill manager buys it but he wouldn't go out and buy something which he knew would be environmentally damaging." "I don't think we as a trade have managed to get the message particularly well across to the public to make them aware of some of the issues involved." "Suppliers' views are like ours I suppose really - as soon as somebody says, 'what's your environmental policy?', then they start getting worried about it - up until that point, well...."

009 "... the sales operation and the refurbishment operation have now come together and form a very powerful marketing tool because the marketers can link with the salesmen and advise that they sell second hand mainframes or systems that promote this operating system ... they were previously independent, fighting one another and shooting one another in the foot!"

004 "There was a true emphasis on this product when we started out working with this particular sub-contractor that the materials would be recyclable. The problem is that becomes diluted in the process between your initial design development and the manufacturing and marketing of the product - to get that message right the way down the line to your end customers is very difficult."

008 "there was some sort of corporate environmental group but the information doesn't seem to have filtered down through the company."

001 "It is important for everyone to be aware of the policy. Everytime an environmental enquiry comes into the office from a client it is fed back to me so we can think about what particular steps should be taken at any specific time that is why an Environmental Unit had to be set up within the company and not as an independent company. All non-administrative staff are engaged in Continuing Professional Development (CPD) programmes of which the 'environment' is a part."

008 "I mean the communication has to emanate somewhere and it helps that designers understand the issues and yeah, we find we can give guidance to clients because of our past experience, but if a client knows his business anyway, arguably there shouldn't be a great need for input." "I think in terms of communication then you're going to have to use our - well our media is one of the main media's by which one can communicate."

011 "we do have kind of meetings where we talk about issues and things like that. It could be like an informal office thing where people have the chance to air their opinions about what the company should be doing and how they could do it." "E-mail is working very well and we're looking at ways of video conferencing and stuff like that ... we can be designing products over here for the States and can be getting an input from over the other side of the Atlantic, almost straight away."

010 "Designers do have, sometimes, the ability to show that there are better ways of doing things and I think if we saw something that was environmentally seen as outrageous or against the moral principles that we have, we would probably be the people to blow the flag, who could sort of suggest ... communicate other ways of doing things..."

003 "you've got designers on one hand who are great communicators and then you've got the environmentalists on the other hand who are great scientists ... because the scientists can sometimes talk over peoples' heads we don't understand them so what we need is somebody who is a good communicator and somebody who is a good scientist and you need to marry the two together so they can actually create an effective message that people can understand. I think this is the key to it all."

005

002

Individual environmental
initiatives - no
mechanism to transfer
knowledge

Figure 6.13

6.6.6 Changes in the design process due to the incorporation of environmental criteria

This theme chart (Figure 6.14) illustrates whether respondents felt that there would be a change in the design process as a result of incorporating environmental criteria. Changes in the process are acknowledged by responses at the top of the axis, no change to the process is indicated in the middle range of the axis and at its base, are the comments of those respondents who felt they had no experience to say one way or the other whether the design process would undergo a change.

About half the people interviewed felt that environmental issues would cause a change in the current design process. Both company and consultancy respondents overwhelmingly felt that a change in the process was most likely to occur at the initial stages of design development. The design feasibility and concept stages were highlighted because of the need for greater amounts of information to complete a feasibility study and to develop initial design concepts which met the various environmental criteria. Within current design processes, the feasibility stage is largely outside the control of the designers; this means that many important design decisions that effect the life-cycle environmental impacts of a design are being made by non-design personnel. Two possible solutions to this problem are:-

1. Environmentally informed designers are included in the feasibility stage of the design process
2. Those making decisions at this stage are made aware of environmental design criteria and the subsequent environmental impacts of design decisions made.

Most respondents felt that there would be an increase in collaboration between suppliers and customers if more rigorous environmental criteria were applied to the design brief. The main concern was the need for greater amounts of time in order to understand the implications of new environmental criteria within the whole design process.

Of those that thought a change in the design process was unlikely, three of the interviewees were technical operation managers or environmental managers from the company respondents. They admitted to having no real knowledge of the intricacies of the design process on which to base a decision. The rest were mainly design consultants who were of the opinion that there should be no change in the design process as environmental criteria was just another restriction on the designer and should be treated in the same way as others, such as cost, quality, size, materials etc. They felt that the process would be 'evolutionary rather than revolutionary.'

Changes in the design process due to the incorporation of environmental criteria

Companies

Consultancies

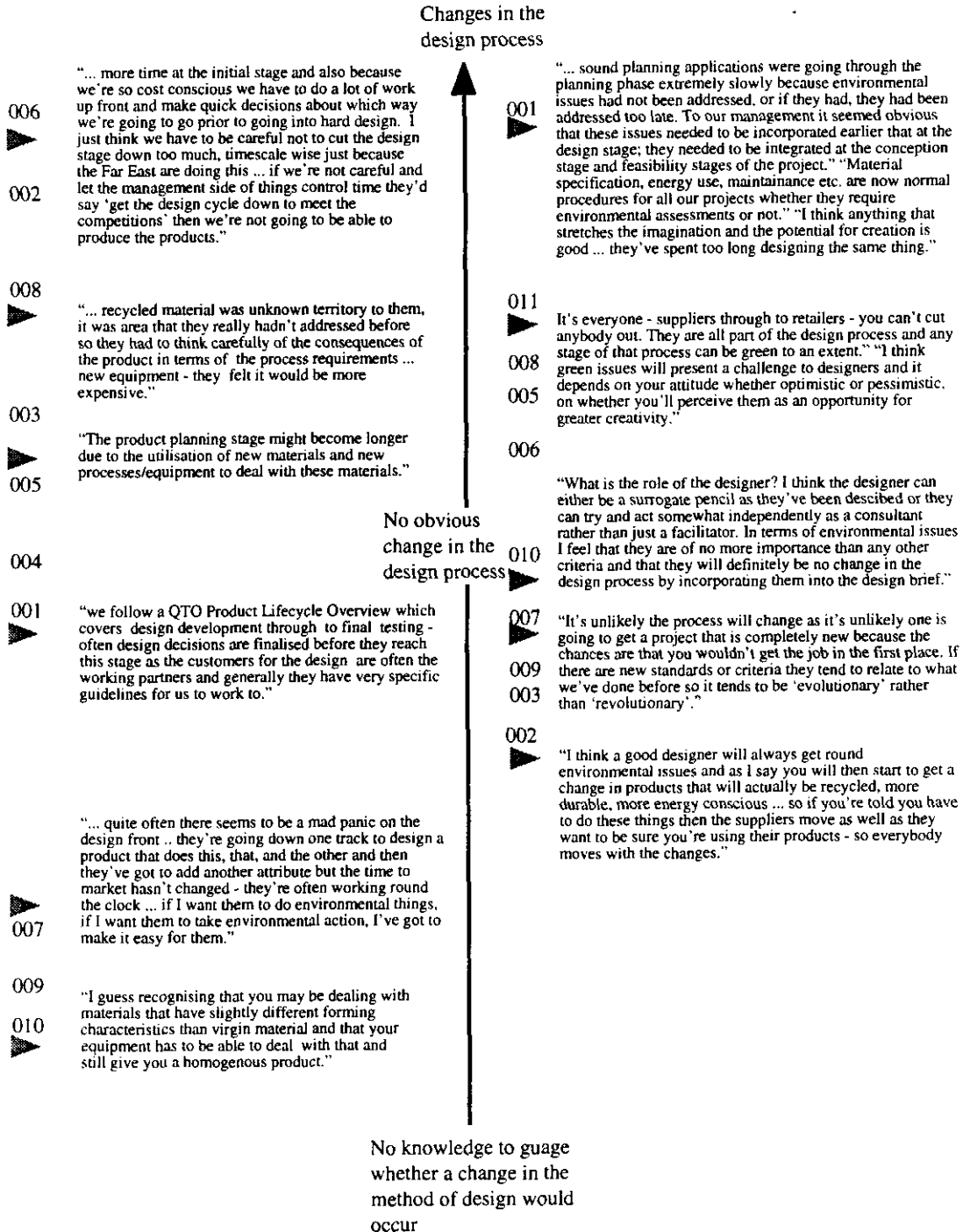


Figure 6.14

6.6.7 Information needs for designers to produce effective ecodesigns.

Information requirements to achieve effective environmentally responsible design were basically represented in the responses from interviewees by two schools of thought; those who felt no new information was required and those who considered that new information and training was a necessity for the future practice of successful environmentally responsible design. These two views are represented on the axis of the following theme chart (Figure 6. 15).

Four consultancies felt that designers could get by with existing information. The problem they saw was that there was too much information to wade through and that it was difficult to find the time to pinpoint relevant sources to access a subject area. A comment was also made about the amount of mis-information around and the difficulties thus associated with attempting to clarify whether or not your information is correct.

Formal training was not mentioned as an issue by any of the consultancies, except CON001 who have already implemented annual staff training programmes of which the environment is part.

COM007 and CON001 have environmental information and training programmes already in place and to date they seem to be effective in increasing the awareness of the staff and the positive environmental action of the organisation. Both mentioned software packages associating these with various types of Life Cycle Analysis (LCA). LCA has been widely publicised as an effective method to incorporate environmental factors within design development. Both companies were inclined to disagree with this and although both viewed the overall concept of LCA as being very valuable they felt, in practice, that a much simpler, 'ball-park' analysis would be more appropriate.

Nearly all respondents expressed a need for comprehensive, accurate and simple environmental design information. Information and training concepts were identified, such as:-

- a central environmental design information centre, from which one could access and obtain information,
- well presented information for everyone - easier to persuade clients,
- agreed global guidelines within all industry sectors,
- training through action - hands-on projects
- government supported ecodesign projects.

Information needs for designers to produce effective ecodesigns

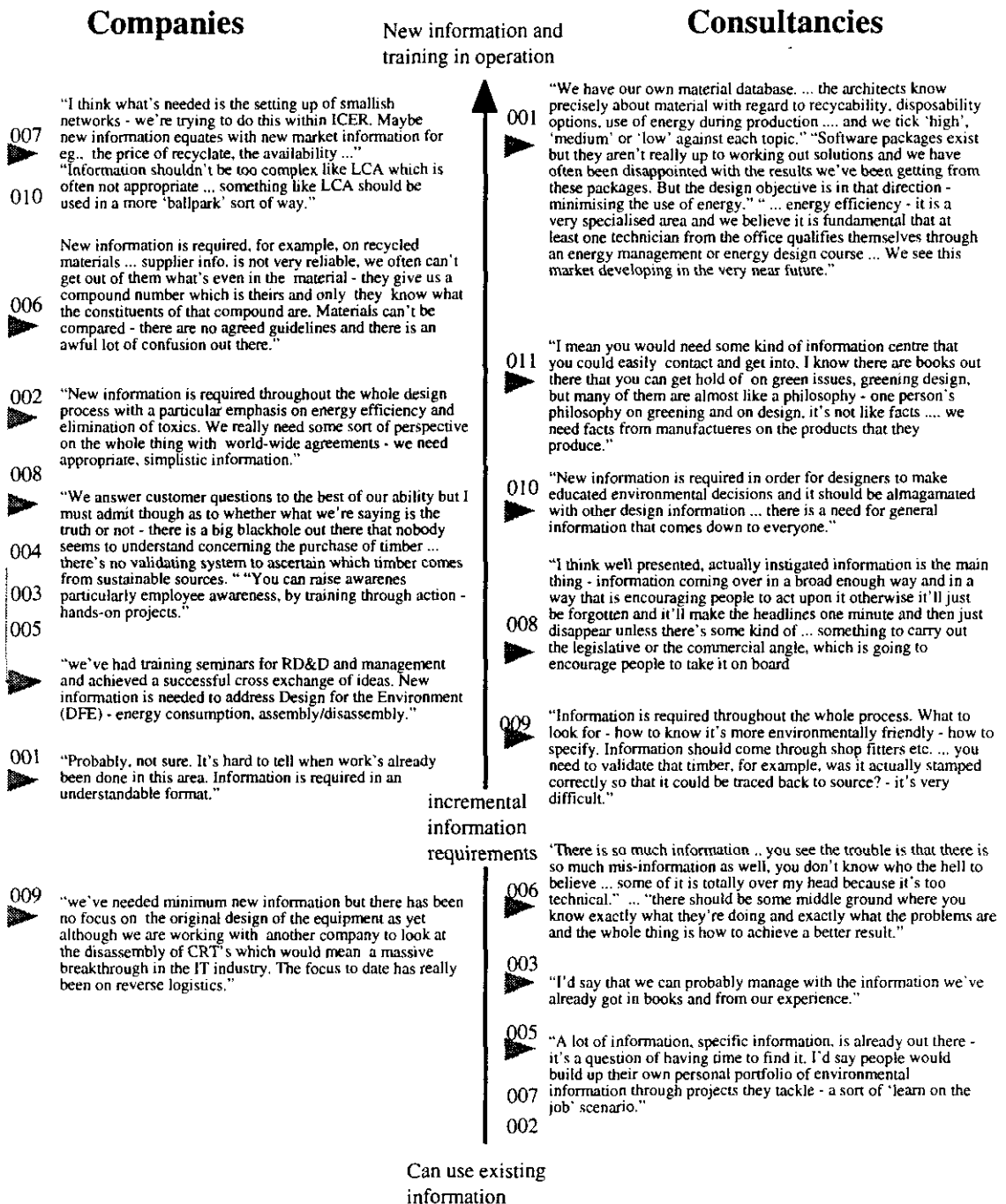


Figure 6.15

6.6.8 Market influences on ecodesign development

This theme chart (Figure 6.16) indicates whether respondents felt that market forces encouraged environmentally responsible design. The responses at the top of the chart are from companies who perceive themselves to be leading the market (or one of the leaders) with regard to environmentally responsible design. Those responses at the lower end of the chart are from respondents who felt environmentally responsible design would only be as a result of reacting to market demands.

All respondents considered that market forces were a powerful driving force for change, especially when some felt that the government were not going to implement environmental legislation to any great degree and therefore environmental action and change would be as a result of market pressures.

COM007, COM009, COM010 and CON001 considered that they were the environmental leading edge in their particular industry sectors. Even so COM009 and 010 were very dependant on the 'whims' of market demand for the continuing success of their business and all four businesses agreed that they were still operating in a market-driven environment.

Those companies and consultancies that were incorporating environmental changes for competitive reasons, and this applied to most of them, felt there was no way of overcoming market pressure. Many of them were exporting products to Europe, especially to Germany, which had influenced many changes in product or packaging design because of the German's stricter environmental laws.

The market was considered both a barrier and an opportunity for environmental change. In some cases new, more environmentally benign technologies couldn't be implemented because they were deemed too 'radical' for current market trends. In contrast, some of the consultancies thought people were now more aware of 'marketing shams' and would be more inclined to lead the market rather than the other way around; they felt that there were opportunities for different priorities to come into play within the market.

Market influences on ecodesign development

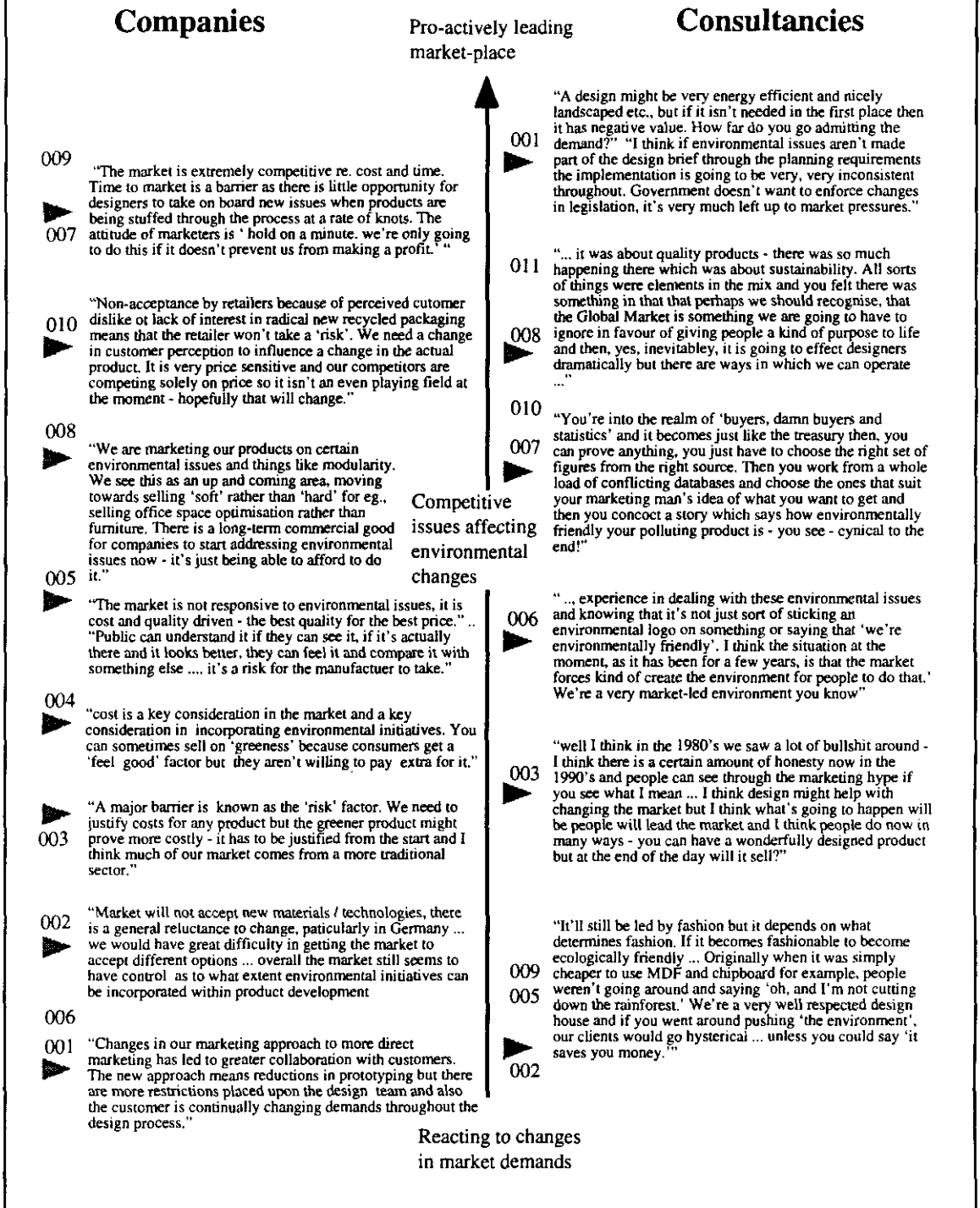


Figure 6.16

6.6.9 The impacts of technology on ecodesign

The axis on this theme chart ranges from, at the top, new technology encouraging ecodesign strategies to, at the lower end, no environmental input into design due to technological advances.

The more pro-active consultancies and companies felt that there were many opportunities for new technologies to encourage more environmentally responsible designs and already there were examples of this. They did acknowledge however that technology had limitations. There was still much that designers could envisage but the technology was not currently available to achieve it.

It was mentioned that changes to products tend to be incremental and not technology led. Therefore technology was unlikely to play a large part in 'greening' design. However, outside mainstream products, Smith, Roy & Potter (1996) found that more radical 'green' designs did occur through the use of different technologies. This survey covered projects including:

- an outdoor floodlight cut energy use down by 20% or less of the halogen lights it was replacing;
- a rechargeable battery design - contained low levels of cadmium and nickel and each battery replaced 3,000 disposable batteries;
- the development of a new aerosol system that uses compressed air as the propellant in preference to liquefied gas.

As the theme chart shows, many of the company respondents felt that technological developments had focused on producing new manufacturing equipment to deal with more environmentally benign materials.

Another point raised regarding technology and environmental issues was that in some cases supposed new technologies actually produced more environmentally damaging products, e.g.. recycled paper using more chlorine than non-recycled paper stock (CON003).

Generally, a pattern in the theme chart emerged of more technology led sectors, like IT, feeling that technology would play an important part in greening their industry although, ironically, it was because of rapid technological changes that more and more IT equipment was becoming redundant. This leads to the need for a refurbishment industry. At the moment, time, and therefore cost, is not wasted on servicing or repairing products that have short life-cycles due to rapid technological advancement.

The impacts of technology on ecodesign development

Companies

Consultancies

New technology encourages ecodesign strategies

- 007 "Led very much by technological improvements and we've been doing upgrades now for at least 20 years - more for cost reasons than for environmental ones ... it's called 'protecting the user's investment'. The older refurbished models are exported out to the old Eastern block. Designers must be aware of the technological advancements in order to keep ahead"
- 009 "... at one time everytime we brought out a new mainframe they'd chuck out their old one because it was no longer sexy and there was this new one out that had go faster stripes on it, you know ... but nowadays they can't afford to do that but they still want to expand ... the answer is simple, you use the equipment from here, refurbish it as new and compliment the existing equipment and keep the customer happy."
- 004 "... technology-led means a continual demand for more function so although the component size is decreasing the amount of function required is increasing and so the overall size of the PC is staying the same ... Technological changes will encourage more environmentally benign designs such as stand-by modes and the like."
- 001 "Technology is the main driver for product development. Product lives are becoming shorter and the longer life concept is not really commercially feasible" ... " ... you've got to be in the door pretty quick to get any advantage out of the changing technology. ... For cost reasons time isn't wasted repairing or servicing a broken machine ..."
- 010 "We use technology to design new process equipment to deal with the many new recycled materials. Process rather than product is the focus here."
- 003 "Changes to products tend to be incremental and not really technology led ... it's no good producing products that utilise new, more environmentally benign technologies if the market will not except such products."
- 002
- 008 "Technology probably plays a role in the sense of new materials and new processes to mould these materials and on finishes and veneer technology, but not particularly from an environmental perspective."
- 005

- 001 "Our dream would be to design zero energy buildings but this is very much a dream. Second best would be to design naturally ventilated buildings but, building in town centres causes problems with dust and pollution and this ventilation is not possible at the moment."
- 011 Again there are a lot more stronger issues than 'environmentalism' which involve design - things like the design language and things like that, I think it is more electronics-led and about where electronics is going. I would like to think that it is going to be green issues but at the moment it's technology."
- 008 The march of technology is dictating the way in which people, or some people, market the design process - you know, 'we can cut our development time by half' ... in the next few years the whole cost of this will come down and again hopefully ideas and creativity will come back to the fore."
- 003 "there are so many ins and outs of paper and the technology now - sometimes they have to use so much chlorine to recycle the paper that it's actually creating more damage to the environment than virgin paper."
- 010
- 006 "Clients will have a policy whereby in all service areas you will have low energy lighting, sometimes when you walk around pubs and things you'll see that they've got low energy lighting in the trading areas - we personally fight against that as the fluorescent lighting is not at all flattering for complexions, it gives a grey/purple light whereas your standard lighting is tungsten so you get a red background which is flattering to people's complexions and so is more user friendly."
- 009
- 007
- 005
- 002

No environmental change due to technological advancement

Figure 6.17

6.7 Conclusions of transcript analysis

The theme charts have produced a similar hierarchy of company and consultancy environmental attitude and awareness as was produced by the environmental footprints. Those consultancies and companies that had, or were moving towards, a pro-active environmental footprint, have repeatedly been placed at the top or near the top of the theme charts in the majority of themes covered (e.g., CON001, COM007, COM010). In comparison, the more 'cynical' footprint design consultancies have remained at the lower end of the theme chart hierarchy (e.g., CON002, COM001, COM003, CON003).

The themes highlighted from the transcript texts are generally interlinked; a company or consultancy that has an environmentally responsible attitude tends to be very aware of the environmental issues relevant to its business; it tends to be thinking more long-term about product development; it tends to be leading suppliers and customers rather than being led; and it tends to have invested time and effort into securing the appropriate environmental information for its needs.

From the examples identified in this small survey, such firms do not generally advertise their environmental credentials but rather, integrate them quietly within their everyday practice - reasons given for this were:-

1. They were aware that many previous environmental claims from manufacturers turned out to be false which had resulted in consumers being dubious of 'green' credentials,
2. By integrating environmental criteria subtly within business practice, companies are less likely to be 'picked on', investigated (by media, competitors) and ridiculed - the latter issue was one which concerned some consultancies (CON006, CON002, CON011) who felt that they could not be expected to be taken seriously by advertising themselves as a 'green' consultancy.

Many of the company respondents from this survey were reactive in their stance to environmental issues. This is illustrated by the footprint profiles produced. It is also represented in the fact that many of the companies were placed in the middle area of the theme charts. *This indicates that many companies realise the importance of recognising future environmental legislative goals and predicting market demand in order to remain competitive within their various industry sectors.*

Consultancies, in general, generated a more 'cynical' environmental footprint profile. On reading the transcripts further, the initial comments which helped generate the environmental footprints were supported by more explanatory information; thus, in retrospect, the consultancies are perhaps not as cynical of the environment as they first appear to be. For example, in Figure 6.8, the consultancy environmental footprints indicate that many of the respondents are relatively short-term in their vision for environmental

design and business management; however, the transcript texts explain this characteristic in a less pessimistic way - it is apparent from this information that consultancies generally feel that they have little freedom and flexibility to operate their own philosophies within product design. Therefore it is extremely difficult for them to plan a longer-term design strategy as they are continually reacting to (different) client demands. Also, as consultancies tend to be small businesses, the concept of formal planning and management tend not to occur to the degree that they do in larger companies.

The environmental 'vision' discussed by designers from the consultancies was one of a wider context than their own businesses - it had a global perspective. It was concerned with the momentum needed within society for the environmental issue to be fully accepted and integrated. The 'feelings' of designers entered into this discussion - what power do they have, the concept of not being able to turn down contracts on environmental grounds. One consultancy mentioned that they tried to be selective about which design contracts they accepted but in reality, for cost reasons, this was hard to do but they said they definitely drew the line at contracts involved with 'defence' for example so there was an ethical 'limit' in this decision making process.

It is important to note that the footprints have not been altered to incorporate this other, more hidden information found in the transcripts text. The 'evolution' of the analysis is an important factor in the research findings. It illustrates how the initial perceptions of the results may alter, or the context in which they are placed may change, to produce greater explanatory information to support the general research findings. The use of both the footprint and theme chart methods of analysis together thus provided a more complete understanding of the interview responses from the main research study.

6.8 Summary of main research findings

The evidence from the twenty design consultancies and companies interviewed for the main research study suggests the following:-

- Attitude, awareness and action are very much interlinked. For example, those businesses with an environmental expert on site (CON001) have implemented a comprehensive and successful environmental design strategy, far ahead of the majority of other firms. Organisations with a reactive attitude to environmental issues also have a relatively poor awareness of the main environmental issues and have only implemented, in most cases, 'one-off' environmental action, for example COM003.

- There is a good argument for integrating environmental expertise within the design team. This was illustrated by one of the consultancies (CON001) whose in-house environmental unit works very closely with the designers, validating all environmental decisions throughout the whole design process. The unit acts as a focal point for environmental information for the whole firm and communicates between suppliers and between clients transferring relevant environmental information and responding to external environmental queries.
- The responses given, particularly from designers in the company sample seems to confirm the earlier conclusion that there is a gap between environmental policy and environmental practice (with a focus on design and development). Although all of the companies interviewed had prepared an environmental policy, there was little evidence to suggest that these policies had been implemented to any great degree. In the area of design and development, design personnel in many cases, were not even aware of the general contents of the environmental policy, and even less so of the content directly related to design and development practices. This area of (non)communication within companies and between members of the supply chain needs to be addressed if effective ecodesign practice is to be a reality.
- Cost, legislation, market and internal philosophy were seen to be the prime drivers in influencing companies and consultancies to adopt an environmental perspective. Industry sector and size of business appear to have no relation to which drivers are more likely to affect change, although the consultancies were particularly influenced by their client priorities. The clients, are in turn influenced by the above drivers - so in effect, the client generally passes down to the design consultant its own reactive stance on environmental issues.
- Information and communication appear to be key requirements for the progressive development of environmentally responsible design. Many interviewees were confused by the amount of information already available and they were concerned about how much of this was mis-information. There was an obvious need for simple, easily understandable design information, information on environmental agendas and goals, and information on agreed global environmental guidelines.
- This survey suggests that the design process would either stay the same and the environment would be treated as just another criterion or constraint, or the design process would change as a result of incorporating environmental design. Time was a key issue as it related directly to cost. Many thought that more time would be needed in order to familiarise oneself with new environmental information with a particular emphasis on increased time requirement at the initial stages of the design process. The

indication was that this requirement would decrease with increasing familiarity with the subject area.

- Many designers thought that the opportunities for greater creativity would be enhanced by the incorporation of environmental criteria within the design brief. They also perceived there to be a shift in the focus of design towards environmental issues; the main point raised was that of a move away from hardware deliverables in product design towards a greater degree of software design where the service and interface is the 'designed' product and not the 'box'.

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ECODESIGN

Chapter 7

A Discussion of the Research Findings: Developing an EcoDesign Framework

7.1 Introduction

This chapter will integrate and discuss the findings from the literature review, pilot studies and case study research. The findings from the pilot and main research studies have provided insight and understanding into how design-based companies and design consultancies can begin to incorporate environmental responsibility into design and development practices. The integration of environmental criteria into design thinking is a new and challenging area and the findings build on existing ecodesign research to provide a greater understanding of the barriers and opportunities facing designers and companies wishing to develop environmentally responsible products.

The focus of this chapter is the integration of environmental attributes and concepts into design and development processes. The initial aims of the research project were to establish best practice guidelines in this new and developing field. However, both the literature review and pilot research studies showed that there was little evidence of a best practice in current design and development processes and thus the emphasis of the main research focused on current design action and attitudes to ecodesign in UK design-based companies and the UK design consultancy industry. In order to understand the context, the barriers and opportunities for integrating ecodesign philosophies within the design process it is imperative that the key issues identified from both the literature review, the pilot studies and the main research are discussed and reviewed.

The literature review highlighted issues such as:

- the historical development of a more ecological design perspective [see Chapter Two, 2.4];
- the characteristics of the different terms associated with ecodesign [see Chapter Two, 2.6];

- the technological, market and management factors impacting in this area of design [see Chapter Two, 2.6 & 2.9];
- the current understanding of long-term sustainability [see Chapter Two, 2.6.4, 2.10].

The pilot studies and main research identified concepts such as:

- the difference between environmental policy and practice i.e. management comprehension vs. practical implementation [see Chapter Four, 4.3.3, 4.3.4 and Chapter Six, 6.3.2 (a), 6.6.2, 6.6.3 & 6.6.5];
- the understanding of terminology from a design perspective - perceived characteristics of the term 'ecodesign' [see Chapter Four, 4.2.4.2, 4.5 and Chapter Six, 6.3.3 (b)];
- barriers and opportunities for ecodesign initiatives [see Chapter Four, 4.3.2 and Chapter Six, 6.3.3 9a), 6.6.4] ;
- information needs for designers [see Chapter Four, 4.3.2 and Chapter Six, 6.3.3 (d), 6.6.7];
- changes in the design process as a result of integrating environmental criteria [see Chapter Four, and Chapter Six, 6.3.3 (c), 6.6.6];
- the communication of environmental issues within companies with a particular focus on communication to and within design and development units [see Chapter Four, 4.3.4, and Chapter Six, 6.3.3 (g), 6.4.3].

The first section of this chapter will address what is meant by ecodesign; it will discuss the understanding of this term within current design-based industry, focus on information needs, the concept of changes to the design process and the concerns of designers.

The second section in this chapter reviews the strategic position of ecodesign within the context of company policy and supply chain relationships. Issues such as the management of design and the prioritisation of design will be central to this section.

The chapter concludes by considering a strategic framework for the development and integration of ecodesign philosophies within the 'greener' company structure.

7.2 Understanding Ecodesign; definitions, information needs and practical processes

This section of the chapter addresses:

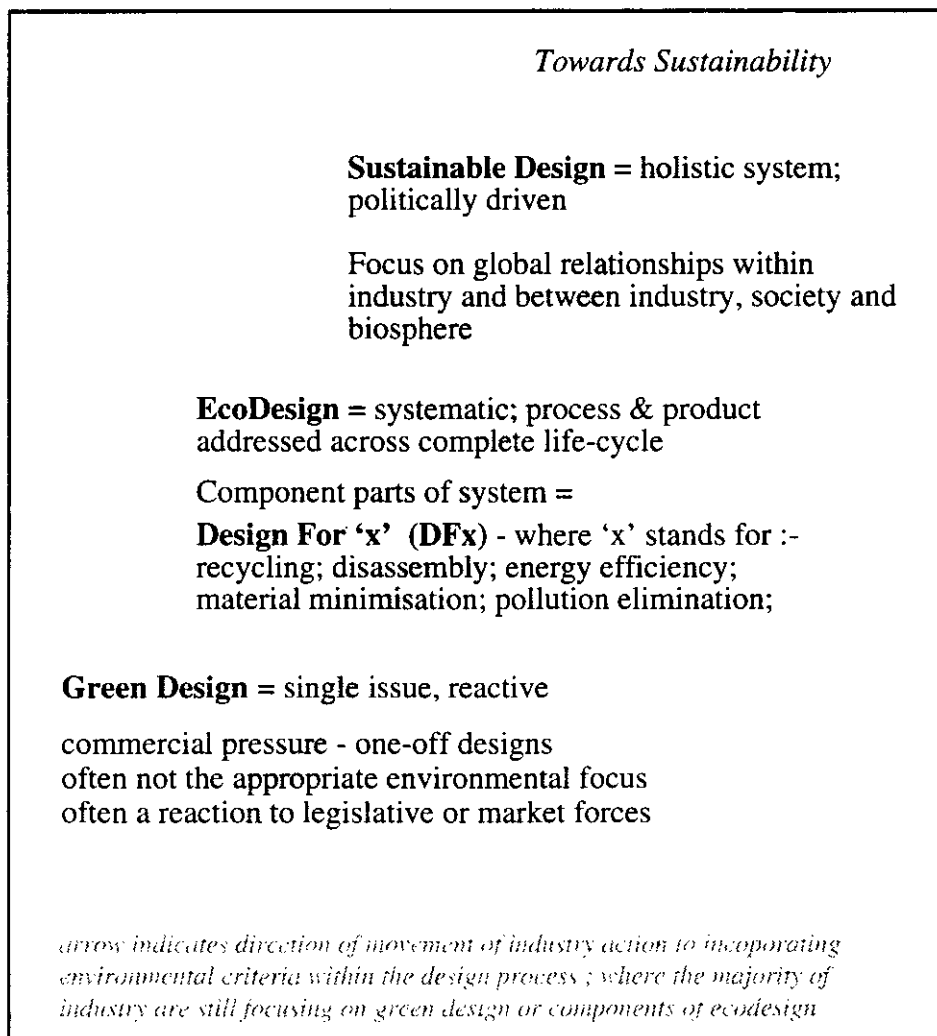
- what is meant by environmentally responsible design; the understanding of this term within current design-based industry;
- the information needs of designers to effectively integrate environmental attributes and concepts within the design process;
- the concept of change to the design process by incorporating an environmental perspective within design problems;

- concerns of designers to including an environmental perspective within design and development processes.

7.2.1 A Definition of Environmentally Responsible Design

A number of definitions of environmentally responsible design were presented in the literature review in Chapter Two [see Manzini (1992); ECO₂ (1994); OTA (1992); Ryan (1992 a&b); Roy (1994); van der Ryn (1996)].

Many of these referred to different levels of environmentally responsible design from concepts of 'green' design through to those of 'sustainable' design. The different levels of environmentally responsible design are shown in Figure 7.1, developed by Dewberry and Goggin (1995). This hierarchy indicates that there are a number of stages to be reached before a comprehensive environmentally responsible design level is attained.



A sustainable design concept is currently impossible to achieve without a complete overhaul of present economic and development systems; such design practice would address global problems associated with production / consumption cycles, unfair trade, ethical and moral values. This is a concept of design that requires an intricate understanding of global systems, and requires global co-operation from political, industrial and social players. This will only occur if:

1. there is a directional lead from the top down, from a re-evaluation of political and economic goals and,
2. if there is a greater understanding of global relationships and sustainability from the bottom-up, for example through Local Agenda 21; through local politics, local community action and local education (LGMB 1995)

Ecodesign is a systematic approach that attempts to reduce and balance environmental inputs at each stage of the life-cycle of a product from raw materials extraction to end-of-life disposal. Component elements of this system can focus on disposability, on energy efficiency, on minimisation etc. These elements are represented in the matrix discussed in Chapter Two, Figure 2.7, p34. In industry today such elements are often described under the generic term of Design For X (DfX), where X is the component part. DfX are components of Design for Environment (DFE), a term which originated from the USA, and which is recognised as being a similar term to ecodesign.

The most basic, most reactive concept of environmentally responsible design is green design. It generally results from a commercial or legislative drive for a company to focus on one or two environmental issues concerning a product or product group; it also often relates to legislative pressures driving a 'clean -up' of manufacturing processes.

As a rapidly expanding field it is recognised that such terms will develop and change as progress is made in understanding how ecodesign differs from current patterns of design practice.

7.2.2 Understanding the concept of Environmentally Responsible Design

The pilot and main research findings showed that designers held a variety of opinions as to what environmentally responsible design was. The majority of designers are currently aware of only a few environmentally responsible design strategies; namely those strategies at the lower end of the hierarchy shown in Figure 7.1, which come under the heading of green design.

Predominately many of the designers questioned in this study viewed environmentally responsible design to mean a concept addressing specific environmental issues such as

recycling, reducing energy consumption and eliminating toxic or hazardous materials. Some of the design respondents, particularly those from design consultancies, defined environmentally responsible design in a more holistic way; from a life-cycle design approach to that of sustainable design which asks complex questions such as the basic necessity for the existence of a product. Although some of the design consultants obviously realised that environmentally responsible design could relate to issues currently outside the 'remit' of the design brief (i.e., the *need* for a product vs. the *desire* or market demand for a product), only one respondent from the architectural design consultancy had put into practice this 'higher' level definition of environmentally responsible design (see Figure 7.1).

Designers' definitions of environmentally responsible design in this study include:-

green design concepts:

- minimising the use of raw materials and the production of waste through the careful design of products:
"minimisation is the key point I feel. For example, with packaging, no packaging = 100% green packaging" (COM003)
- design for disassembly

ecodesign -> sustainable design concepts:

- ensuring the output from the life-cycle of a product isn't harmful
- not designing unnecessary products; not contributing to addictive consumerism
- product sympathetic to the environment in which it is being used or displayed
- designers acknowledging the wider issues - beyond the ignorance of government and client attitudes

In the architectural design consultancy the environmental impacts had been considered across the whole life-cycle of the design; this process had been facilitated by an internal environmental unit. The in-house designers addressed environmental queries to the environmental unit who transferred appropriate information down the line. This proved to be an extremely successful initiative and resulted in the consultancy analysing previous design projects to gain a greater understanding as to whether their initial judgements on the environmental impact of a design project had been accurate. This consultancy considered the concept of learning by example to be central to future developments in this area.

In contrast to this systematic ecodesign strategy, the majority of design respondents were unaware of a general company policy in this area; in the case of the designers in consultancies it was often true that there were no formal environmental policies since business tended to be conducted on an informal basis. Many of the ecodesign initiatives to date related more to green design where the focus had been on one or two environmental impacts of the product (or associated process).

7.2.3 Information requirements for designers addressing environmental impacts within the design process

The pilot studies and main research findings showed that there were generally two schools of thought regarding the information needs of designers in order to achieve successful ecodesign practice. The first of these is the concept that existing information is sufficient to facilitate effective ecodesign strategies. Designers who agreed with this statement felt that not only was there already information 'out there' but that this information was vast; the main problem they envisaged was the capability of designers to access and select appropriate information to guide environmental design decisions. A recurrent comment from respondents in the survey research was a concern regarding the amount of mis-information on ecodesign and other related areas.

'There is so much information you see the trouble is that there is so much mis-information as well, you don't know who the hell to believe. Some of it is totally over my head because it's too technical , there should be some middle ground where you know exactly what the problems are and the whole thing is how to achieve a better result.'

Consultancy 006

Another theme addressed by many respondents was the lack of direction and guidance in this area. There was also concern over the lack of global validating systems for the purchasing of resources - whether these be raw materials or finished components (see Chapter Six, 6.5.7) These issues are mainly associated with government inaction on a global scale. Designers perceived the need for agreed global guidelines and agendas to be defined in a general strategy and also at an individual industry level. The feeling was that this would enhance the scope and direction of ecodesign and would greatly influence the dissemination of accurate information through the system.

'We really need some sort of perspective on the whole thing with world-wide agreements. We need appropriate, simple information.'"

Company 002

The second school of thought recognised the need for new information in the area of ecodesign. Many of these respondents were aware of terminology such as life-cycle assessments, life-cycle analysis, energy analysis etc., but few felt able to describe what each term meant and where and why such concepts should be used.

'Maybe new information equates with new market information , for example the price of recyclate, the availability ... information shouldn't be too complex like LCA which is often not appropriate- something like LCA should be used in more of a 'ball-park' sort of way.'

Company 007

The general comment was that these terms implied added complexity, cost and investment in time for the design process; all of these are in short supply when designers are working to ever decreasing product design lead times.

A strong emphasis was placed on the need for simplified information (as opposed to information presented in a 'scientific' language), and accurate information directly targeted at the design profession. Some of the main areas where information is currently sought are shown below:-

Subject area	Sources of information
General guidance regarding ecodesign initiatives	a central ecodesign information centre - supported by government/ industry
environmentally appropriate materials	material databases, market information - availability, costs etc.
conservation of resources and methods to avoid waste and pollution	world-wide agreements - guidelines
legislation and other schemes	establishing small industry networks to communicate information
environmental methodologies	training through action - 'hands-on' projects
client related information	information base for design consultancies
evaluation of environmental factors	analysis databases, environmental analysis tools

The research demonstrates that, although designers may come from quite different professional backgrounds, there still seems to be the need for general, well presented information in the area of ecodesign. Many of the industries had specific queries and these would need to be addressed separately; however, a good deal of ecodesign information is generic and can be applied across different design specialisations.

The subject of accurate information is directly related to the process of educating designers. Environmental information and awareness will be vitally important in future design processes and therefore it is imperative that such areas are integrated within current design education in order that young designers have the ability to be discerning regarding the growing 'information bank' in this area. The findings from this study and other ecodesign studies, for example, Bakker (1996), recognise the need for a comprehensive training for designers in the area of environmentally responsible design. It will be essential for designers to understand environmental terminology and environmental design concepts in order to communicate with clients and with other professionals in the implementation of future environmental business strategies. As CON001 demonstrated, another way of bridging the gap between the current lack of understanding of designers to environmental concepts is to introduce an 'expert element' within the design team. This expert acts as a focal point for all environmental decision making regarding design and development and the designers use this 'facility' to guide and direct them, from an environmental perspective, through the various design and development stages. This consultancy also showed that the expert can be

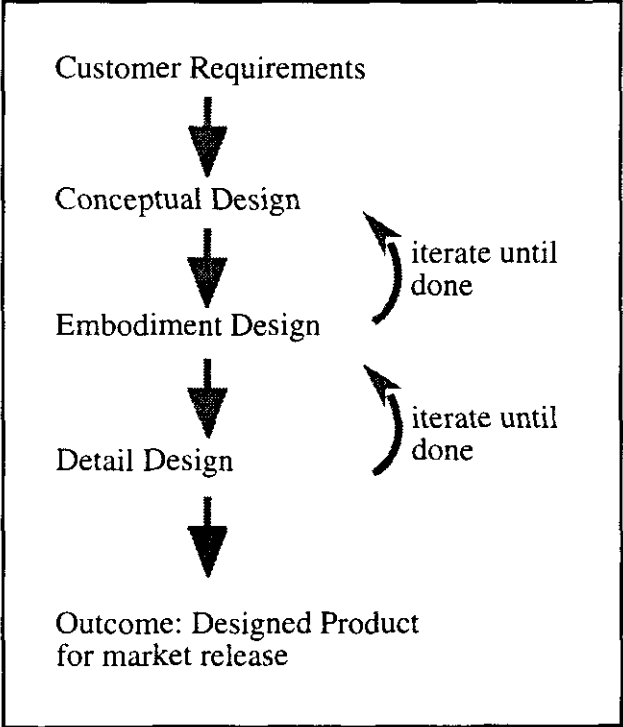
successfully employed in persuading and guiding client decisions regarding the environmental impacts of the project.

The main research study showed that in-house designers and design consultants both relied considerably on the environmental information they received from their suppliers. This is an important point as it raises issues of trust, reliability, and long-termism. It is beginning to be recognised [MacKenzie (1995), AT&T (1995), Boyce (1995)] that introducing environmental agendas into the workplace will encourage the development of more permanent relationships between players in the supply chain. Such concepts were beginning to materialise in this research study where design respondents would comment on the importance of knowing and trusting their suppliers. A similar scenario might be found in the introduction of quality in manufacturing. The environmental issue is somewhat more 'emotive' than the concept of quality and issues such as trust and dependency may well play a bigger part in existing supply chain relationships. The issue of 'greening' the supply chain will be addressed later in this chapter (7.3.2)

In summary, information is a key factor in improving the environmental quality of design. Whether this information already exists or whether new information is required, the output must be easily understandable, produced within clear agendas and distributed in an effective manner.

7.2.4 Changes in the Design Process

The design process was discussed in Chapter 2 (pages). Pahl and Beitz (1984) provide a simple overview of the design process in their model, shown as Figure 2.3 in Chapter Two and reproduced as Figure.7.2 here.



Based on Pahl & Bietz (1984)

Figure 7.2

The main research findings suggest that any changes in the design process to take account of environmental criteria will be most likely to occur in the initial, conceptual stages where decisions are made that have major consequences throughout the whole of the design and development process. Many designers felt that the change would be in the form of increased time requirement for this stage of the process so that they might familiarise themselves with the new constraints of environmental criteria. If this is just a matter of familiarisation with new demands and new information then it might be realistic to presume that this need for greater amounts of time at the conceptual stage will be reduced with increasing familiarity with the subject area. In this sense connections can be made with the concept that 'hands on' experience of ecodesign projects would be an ideal way to encourage the designer to integrate ecodesign issues as a standard concern within the design process.

Many of the design respondents did not have direct experience of integrating ecodesign criteria; some had looked at materials for packaging, others had eliminated CFC's or had addressed recycled paper usage - few had experience of comprehensive ecodesign action. Hence these responses anticipated what might happen to the design process and were not generally based on the respondent's own experience. Those designers who had integrated a more comprehensive ecodesign programme did suggest that the design process might change. To some degree this was based on the need for increased amounts of information, but more importantly, it was related to the concept of the design process extending beyond the realms of design and materials processing into the area of product use and disposal. If the life-cycle of a product or service is to be considered within the design process model it extends the current design process model beyond the factory floor, printing press or building site. Integrating concepts of responsibility for the design beyond the sales stage (for example - reduce, reuse, recycle - materials cascading¹ concepts) are new and challenging and such decisions occur at the concept and feasibility stages of the design project; these are very much the remit of the designer.

The following is a comment from a supplier of a large national company - the latter has set up a product return service for the recycling and refurbishment of their products -

'more time at the initial stage of the design process, and also, because we're so cost conscious (this company operates in an extremely cost sensitive industry) we have to do a lot of work up front and make quick decisions about which way we're going to go prior to going into hard design. I just think we have to be careful not to cut the design stage down too much, time scale-wise, just because the Far East are doing this

Company 006

¹ **Cascading** - The cascading concept is based upon a waterfall and the potential energy of the water lost as vapour and moisture as it tumbles downwards between various plateaus until at the bottom, it eventually reaches an equilibrium point. This analogy shows that a product could experience a variety of energy levels throughout its lifecycle. It would be the responsibility of the designer to ensure that at each stage of the lifecycle, the energy embedded within the product (materials, processing etc.) was at an optimum level so that the product wasn't 'over designed' i.e. avoid using a high grade polymer for disposal packaging. (O2 Pages 1990)

An architectural consultancy primarily involved in retail and leisure design has established it's own environmental criteria checklist throughout the complete life cycle of their buildings, and says,
'... it seemed obvious that these issues needed to be incorporated earlier than at the 'hard' design stage; they needed to be integrated at the conception and feasibility stages of the project. Material specification, energy use, maintenance etc. are now normal procedures for all our projects whether they require environmental assessment or not.'

Consultancy 001

The concept of extending responsibility for the design from the original design process model to one that includes all elements of the design's life-cycle is a complex one. It relates not only to the company responsible for the original design, but also to the users of the design and to those (if not the original company) responsible for the disposal of the product. This new model describes a more systematic view of the design process where there are a number of new relationships involved (see Figure 7.3)

The revised model questions the insular nature of current design processes. It highlights the concept that decisions made at the design stage of product development have considerable impact throughout the complete life-cycle of the product; it also address the fact that if designers are to make decisions regarding the eventual disposal of the product then more complex mechanisms need to be implemented for effective action to be a reality at the end of product life.

Change in emphasis on the design process when comprehensive ecodesign strategies are integrated into business practice.

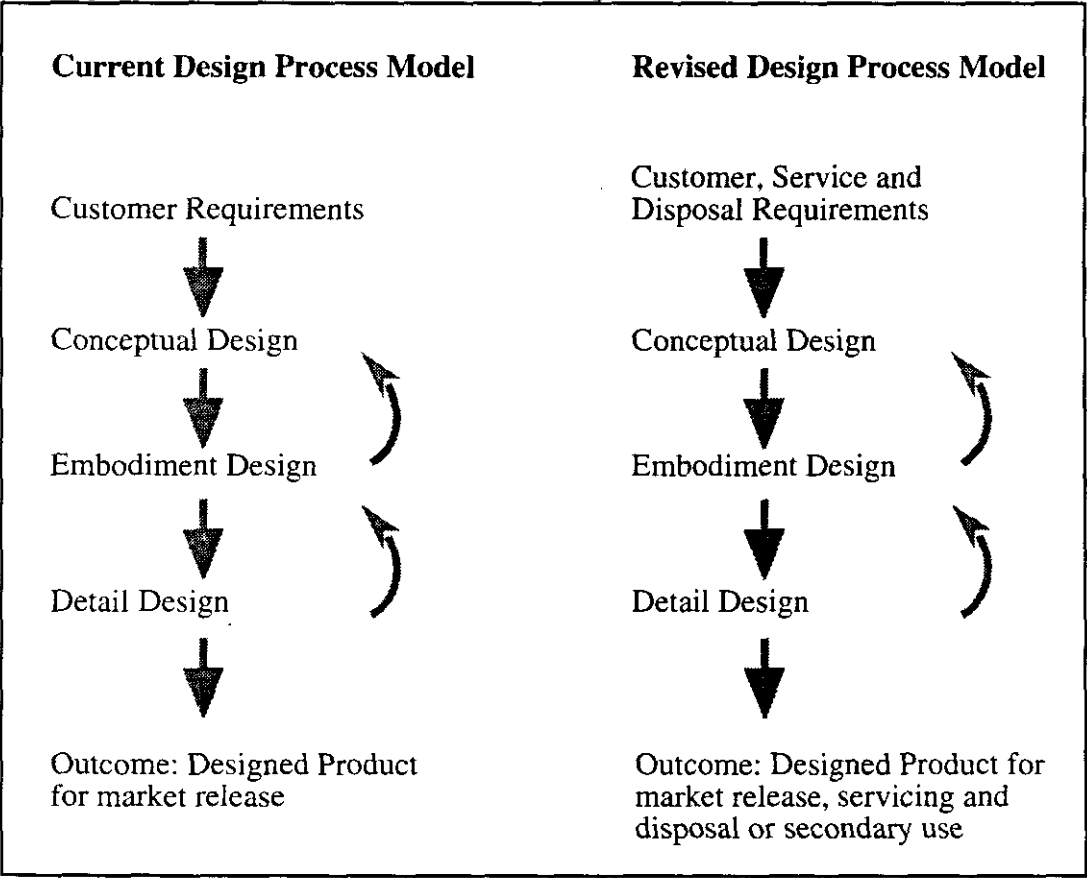
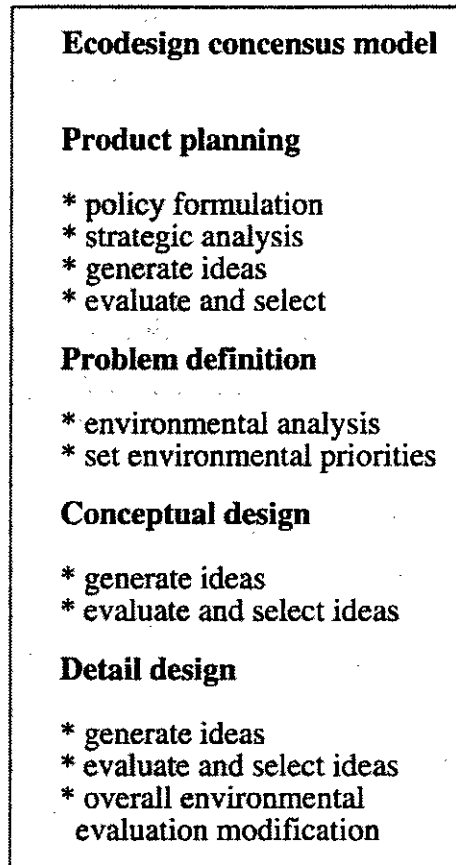


Figure 7.3

Bakker (1996) presents a general structure model of an ecodesign process without the detail of iteration and feedback loops (Figure 7.4). She uses the model to indicate the main stages and activities a designer would be involved with in an environment oriented product development process. Bakker has developed an environmental information matrix from her general model, which shows environmental information currently available at each stage of the process and thus the matrix can be used as an environmental information tool by designers.



Bakker (1996)

Figure 7.4

The actual design process need not change dramatically but those involved with design and development need to have a greater degree of environmental responsibility. Also the context in which the design process is placed needs to be revised to include issues such as supplier, customer, service and disposal integration, a wider 'team base' involvement (MacKenzie, 1995), and the prioritisation of design at a management level, (Cooper,1993). The management of design is discussed later in the chapter

'The scale of challenges facing EcoDesign are likely to demand a new type of design process; more planned, more rational and analytical, less dependent on the intuitive. This must not reduce the essential importance of creativity - but it must harness creativity to a responsible, rather than irresponsible end. Design processes must also be open to external concerns and influences. In many cases it will be essential to work very closely with suppliers - of raw materials, components, packaging etc. to achieve significant results. They will increasingly be part of the EcoDesign team.'

Mackenzie (1995)

Viewing the complete lifecycle of the product at the design stage in this way demonstrates a fully integrated ecodesign philosophy.

7.2.5 Designers' Viewpoints on integrating environmental criteria within design and development.

The general impression given by designers in both the pilot and main research studies was that designers are not empowered to make decisions regarding the degree to which an environmental perspective can be included within the design project. In the case of the designers based in design consultancies the main barrier to implementing ecodesign action was the general resilience to these ideas by their clients;

'Barriers are that clients don't want to know because there is no commercial benefit at the moment for looking at these issues'

Consultancy 003

This direction by the client can also be a positive influence on the environmental leaning of a design project;

'We're a consultancy, we work for the client so if the client comes along and says that environmental factors are particularly important then we get out the book of rules and design them to meet whatever rules we have to comply with. Everything is client driven.'

Consultancy 007

A similar response was obtained from designers in companies. The feeling of being unable to control the wider influence of customer and commercial pressures meant that many designers felt unable to make progress towards including ecodesign criteria within design briefs. Those that had introduced an environmental perspective had generally done so as a result of legislative, market or cost pressures. Cost was bottom line in any decision regarding product development and so many designers felt unable to justify a move to an ecodesign approach on the basis of 'environmental altruism' alone;

'I think the opportunity for us to do things that would be more environmentally positive would be if a customer specified things a little more stringently so we were on a more even playing field and then we could say 'OK, it costs a penny more but it must be costing the Far East a penny more so we can do it.''

Company 006

'Two or three years ago there was a lot of hype about the environment ... we did take it quite seriously and we actually wrote statements about ourselves that we could issue to our customers. Now it's quietened down totally really because prices have become such problem today for our customers. The customer is still interested in price more than whether the materials are recyclable.'

Company 008

Although many of the designers interviewed acknowledged the need for a greater emphasis on prioritising environmental criteria within design briefs, very few had been able to introduce this perspective within their own design projects. The overwhelming reason for this was a 'reactive' one; designers felt that they had no real say in what the environmental agenda was within product development. Some were very cynical of the 'environmental marketing propaganda'; most felt there was little scope in changing a client's mind over these

issues; nearly all mentioned the fact that there was no clear direction or agreed environmental agenda. They thus felt 'in the dark' trying to introduce a perspective into design briefs when ultimately they were not sure of what was right and what was wrong. One of the most discouraging findings was that many designers acknowledged that the majority of the design decisions were made by management before the brief even reached the design team - this resulted in very little flexibility for new ideas at the stage where designers are the main players.

Against this backdrop of designers having to work within the constraints imposed by client and commercial pressures and 'blinkered management', there were a few rays of light in the comments received from some of the design respondents:-

'what we don't want to do is to produce products that are reckless, unnecessary and generally harmful to what we see as the environment. I suppose there is a sort of designer ethic that says that we are minimalists in a sense, that we tend to put things on where they're necessary for a product rather than just adding materials for the sake of adding materials.'
Consultancy 010

'I don't really know what 'green' means. All that I know is that there is a clear need to minimise the impacts of buildings and to minimise waste and to become more energy efficient. That is definitely not a passing phase. It's just a different way of thinking and I think it will eventually sink in. I think the environment issue will have to be incorporated quietly- this is the way I do it with our clients.'
Consultancy 001

In summary, the views of designers on integrating an ecodesign philosophy within current design practice were:-

- Designers are generally sensitive to environmental issues; they have great empathy towards their natural environment
- Designers feel confused by the proliferation of environmental information available. They consider it extremely difficult to deal with and understand these issues on a day to day basis.
- Designers do not have the freedom to make decisions regarding the environmental perspective of a design project; they are constrained to react to client, management, commercial and legislative pressures.
- Designers recognise that environmental issues present a challenge to the designer; many felt including these issues will present opportunities for greater creativity.
- Some felt that the environment was just another criteria to be considered alongside cost, quality, aesthetics, performance etc.
- Those designers involved in more environmentally aware design projects commented on their relationship with their suppliers; they felt that trust and openness are crucial when specifying the environmental claims of products and therefore it is imperative to encourage longer-term commitments with trustworthy suppliers.

7.3 Environmental policy, environmental practice and supply chain relationships

This next sections addresses:

- Why and environmental policy does not necessarily reflect effective company environmental action.
- The changing dynamic within the supply chain

7.3.1 Environmental policy and environmental practice

The management of design in design consultancies differs from that found in the companies. This reflects the differences between the two involving:

- size
- formality
- organisation

The main research study of ten design consultancies and ten design-based companies illustrated the point that design consultancies tend to operate on an informal basis whereas companies tend to govern operations through policy and management initiatives. The one larger design consultancy interviewed did operate under the direction of a policy, however there was still a large amount of personal communication between all levels in the consultancy. It was evident that everyone knew what everyone else was doing and in environmental terms, a unit had been established in-house to ensure that environmental information was disseminated effectively both in-house and to external parties such as clients and suppliers.

The size of organisation is the key factor to the type of management approach adopted. The consultancies tended to be very small companies often not employing more than 10 staff. In these situations policies were not formulated in written form; they were implied and roughly adhered to as 'business practice'. None of the design consultancies, bar the large architectural practice, had written business policies - and not surprisingly none had a formal written environmental policy either. Designers interviewed (who tended to be the managing director of the consultancy) saw no point in constructing a formal policy. They considered a more effective approach to be discussing 'their stance on an issue' when and where it was necessary to do so. One consultancy pointed out the fact that many of the design jobs undertaken were of a similar nature - the design consultancy builds up a reputation in a particular area and by doing this familiarises itself with all the legal, safety and other requirements and thus builds up a 'best practice' approach through 'hands on' experience. In terms of environmental policy initiatives, the consultancies considered that acknowledging an awareness of the issues was a sufficient step to take at first. It was generally felt that the design projects undertaken by consultancies were governed by client policy and thus there

seemed little point in implementing their own policies when these would be over ruled by those of the client. This reinforces the key role that the client has in specifying environmental standards, although it must not be viewed by the design profession as an excuse for taking no environmental initiatives within product development. Those consultancies (CON001, CON006) who had either introduced environmental expertise into the design team or had trained design staff to be more environmentally aware, showed that clients can be persuaded to change product criteria to result in a product with reduced environmental impact.

In contrast, all the companies interviewed had a formal policy structure. The smaller companies interviewed were divisions of larger companies and policies were passed down to the company from head office. Although policies obviously existed within the company structures, very few of the designers interviewed could recall or expand on the environmental policy or mission statement.(see Chapter Six, 6.6.3, 6.6.5) There seemed to be little evidence of the effective communication of the companies' environmental agendas, of which management seemed generally unaware.

Three of the company interviews were conducted with non-design personnel; two of these were environmental managers and the other a manager of a recycling and refurbishment centre. The environmental managers discussed their environmental policies openly and went into detail regarding how design and development would be effected by integrating environmental criteria. They discussed methods of communicating the environmental message in-house, such as via newsletters, seminars, specific training days, notice boards, etc., all of which they confirmed had already been achieved. Unfortunately there was not an opportunity to confirm this with in-house designers of those two companies. However, telephone conversations with two other environmental managers of companies whose designers had been interviewed, suggested that what the environmental managers perceived to be happening was not necessarily the case. In both companies the management view was that effective action was being taken concerning the dissemination of environmental information and company policy. With direct reference to design and development, both environmental managers confirmed that there was recognition at this level and that appropriate action was in place. The designers interviewed in these companies were both head of their departments and neither could expand on the environmental policy of the company; neither could explain how the environmental policy effected design and development; and neither had undergone any training in this area. The question arises as to whether concern for the environment is a 'public relations' exercise by the company management or whether there are sincere moves to introduce an environmental perspective within company practice, the logistics of which still need to be refined and adapted. The latter explanation is the most probable and the focus on the gap between policy and practice is of great importance if effective ecodesign practice is to become a reality.

7.3.2 Supply chain relationships

The main research study shows that a focus on policy and action is directly related to supply chain dynamics. Pressures for change has impacted at both ends of the supply chain; from the raw material end there are concerns over material resources regarding the origin and environmental acceptability of materials. From the market end there are worries concerning customer perceptions of certain products, the influence of environmental pressure groups, reactive attitudes to change, impact of the company on the local community. Within a 'green' context, the number of players in the supply chain increases, particularly at the market end where companies need to justify their action regarding immediate environmental impacts on the local community or justify to their stakeholders the rationale behind a certain investments. Such company initiatives are voluntary at this level, but companies are realising that this type of commitment to 'reporting the facts' is necessary in order to maintain a good company profile and avoid mis-representation and subsequent commercial damage. Concern in the late 1980's and early 1990's over the dubious 'green' claims that some manufacturers were making about their products has had the positive effect of a higher degree of awareness regarding the whole area of 'green' claims. This is true for raw material suppliers purchasing material on an international market, as well as for manufacturers purchasing raw materials and component parts; for clients and retailers specifying orders from manufacturers; and for discerning customers making educated choices over the products they buy.

At the raw materials and manufacturing levels of the supply chain, environmental action is increasingly of a mandatory level and many of the initiatives at the retail end of the chain have been spurred on by this type of mandatory environmental action (for example, end-of pipe process clean-up legislation, global bans on certain raw materials or hazardous substances.)

The effect of 'greening' a supply chain has led to stronger bonds between all of the elements in the chain (see Figure 7.5). These relationships rely very much on an element of trust. For example, at the raw materials supply end the relationship between company and supplier depends on the company trusting the supplier of raw material as to the origin of that material and the supplier trusting the buyer or producer of the raw material as to the origin or production methods of that material. This is due to the fact that the global market is extremely hard to monitor and although legislation might exist to eliminate certain materials, products or practices, it is up to the individual to take as much responsibility as possible for the choices made. The issue of trust was often raised by respondents in the main research study. Many felt it important to try and keep a strong relationship with the supplier as, for example in the case of timber purchasing, much of the global timber market is not effectively monitored and so it is essential to be able to trust your supplier's knowledge and contacts as to the true origin of the timber.

The relationships between the supply chain and the 'greener' company

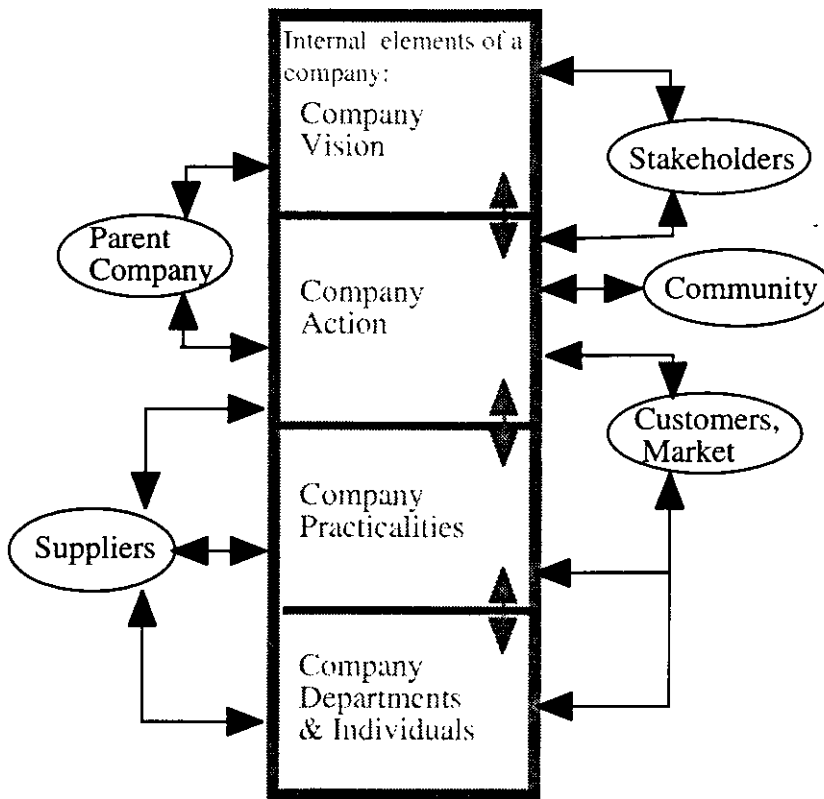


Figure 7.5

From a company perspective it was also important to achieve a good relationship with the customer. In terms of persuading a customer to purchase a more environmentally benign product, most respondents felt that this possibility would be enhanced if an existing working relationship was good. However, this is not always the case:-

One of the respondents recalled a story regarding the introduction of a new milk packaging in a major retail store. The retailer had advertised a comprehensive environmental strategy in relation to product purchasing, packaging, health and safety etc. The respondent's company developed a new milk packaging for the company based on milk packaging sold in Canada and Sweden where it had been very successful. The packaging used 40% less material than the 'environmentally best' packaging then on the market. It cost a fraction of the price and reduced transport costs and the environmental impact of transport as more packs could be transported at once. In essence, it was a more economic, more environmentally benign product than any currently available. The respondent's company presented the design to the retailer; the design was rejected on the grounds that it would be too unfamiliar to their UK customers and wouldn't sell.

(Author's interview with COM010, 1995)

Summary of environmental policy, practice and the supply chain relationship

- Environmental policies don't necessarily reflect environmental benign business practices (the gap between environmental policy and environmental practice). For example, often cost is the main driver for change and positive environmental benefits may be a result of a cost cutting exercise.

- At a design level within companies there seems to be a lack of awareness of the main company stance on the environment. Parts of the environmental policy directly related to design and development are not communicated effectively to design personnel.
- Environmental action concerning design and development to date has tended to be as a result of an individual's interest (an 'environmental champion') in the issue as opposed to a strategic plan to reduce the environmental impacts of product development.(see Chapter Six, 6.4.2) This is viewed as a 'bottom-up' strategy approach (see Table 7.1 in the next section).
- Communication and transparency of information within the company and between those involved in the supply chain are key requirements to the successful implementation of ecodesign strategies.

7.4 EcoDesign management approaches within the 'greener' company

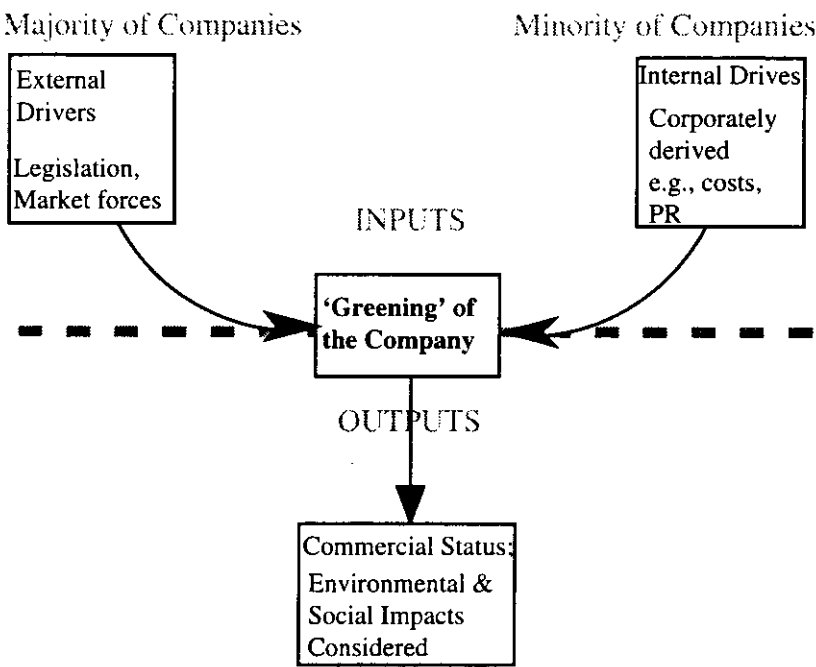
This section of the chapter explains what is meant by the term 'a greener company' and looks at the drivers that influence companies to integrate an environmental perspective within their business practices. Management approaches to design are also addressed in this 'greener' context.

7.4.1 The greener company

Charter (1992) defines the characteristics of a green company as:

- Leadership through environmental excellence
- Openness
- Flexibility
- Holistic / systemic vision
- People-oriented
- Sensitive
- Participatory
- Good communication systems
- Ethical
- Quality conscious
- Co-ordinated
- Integrated
- Collaborative
- Partnership

Charter’s list describes characteristics of an *ideal* green company. Very few of the companies interviewed for the main study showed many of these characteristics with only CON001 displaying the majority of them. Such characteristics represent a very proactive business approach to greening. However, many of the initiatives that have been highlighted by this research study are a result of industry responding to external pressures to be more environmentally aware. The research findings from both the literature review and the pilot and main studies have investigated the various pressures on companies to integrate environmental goals within their business agendas (see Figure 7.6). In the main, companies to date have been reactive in their reasons for integrating an environmental business perspective; reactive to legislative, market, competitive and client / customer demands. Very few companies have tackled these issues based on an internally developed philosophy regarding the environmental betterment of the company.



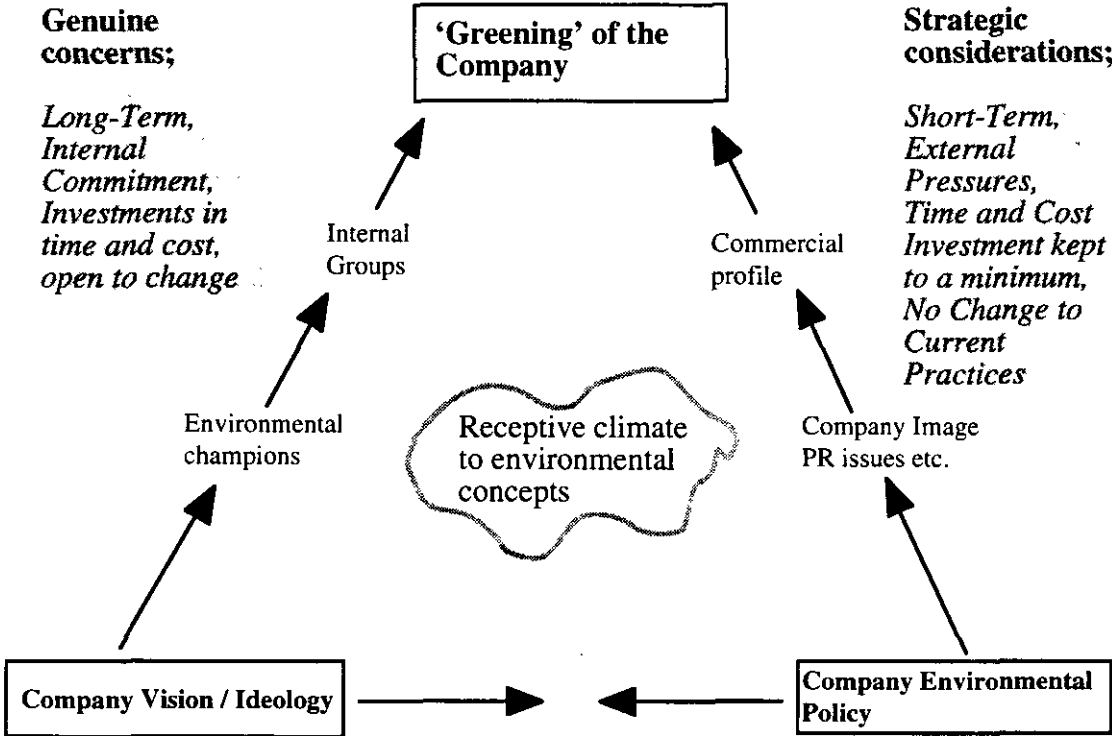
Pressures on companies to integrate environmental goals within their business agendas Figure 7.6

The reasons for this are varied. One of the major reasons is the problem in justifying time, effort and financial resource to looking at these issues in-depth in order to devise an appropriate environmental action strategy for the company to act upon. Those companies who have based their change on pressures from within have usually an environmental champion or champions within the company who drive, direct and challenge management decisions regarding the lack of integration of environmental issues. However, this action tends to be ad-hoc and related specifically to a particular product - action is not usually of a generic nature.(see Chapter Six, 6.4.2)

The tension within a company concerning the desire for them to ‘genuinely’ base their integration of environmental issues on pro-active, internally generated reasons and the reality of including them for more strategic, and often reactive reasons is demonstrated in Figure

7.7. This has been developed from *The Greening of British Party Politics*, (Robinson 1992). There seem to be many similarities between the ‘greening’ of a political party and the ‘greening’ of a company. Both are attempting to outwardly be viewed by either the electorate or customer base as progressive environmentalists whose reasons are genuine, lasting and grounded in the belief that environmental issues must be seen as a priority. The reality in both cases is that decisions are essentially self-interested and relate to the commercial (or political) advantages of the present time; little is based on a long-term vision which is ultimately what is required for ecodesign philosophies or green politics to be effective.

Different Drivers for the ‘greening’ of a company



Concept adapted from Robinson (1992)

Figure 7.7

In all but one of the cases surveyed in the main research study, companies and design consultancies were integrating environmental attributes within design and development for commercial or legislative reasons. However, an example of a change in company environmental perspective was given by two companies; an IT based company (CON007) and a previous subsidiary of this company (COM009) had both initially integrated environmental criteria due to concerns regarding producer responsibility and subsequent product take-back legislation. This initiative gave them a commercial advantage and they are now implementing (COM007 on a more formal level than COM009) the integration of environmental strategies within their long-term total quality management programme. They are instigating environmental design training for design employees and are working closely with academic institutions to raise the profile of the practicalities of integrating environmental

initiatives within business practice. Both companies are now seen as being 'environmental' leaders in their industry sectors - both originally initiated environmental action because of an external driver (legislation) to do so. So, it is important to note that even if a company starts off by reacting to external environmental drivers, subsequent environmental initiatives within the company may well be as a result of an internal drive towards better long-term environmental management.

7.4.2 Ecodesign management approaches

Companies are beginning to recognise that early involvement in introducing ecodesign strategies can create competitive advantage and late involvement can disadvantage their company (van Dijk 1995). Knowing this and implementing effective strategies are however separate issues. The main research study indicated that there were problems associated with communicating environmental goals through the hierarchy of the company structure. Thus design and development staff, who do not reside at the top of this hierarchy, are often communicated within a form rather like 'Chinese whispers'. No one is seemingly aware of the main environmental challenges facing the company or the appropriate action that has been decided upon at the management level. One of the reasons for this may be that such planning never existed in a developed form at the senior management level. Another reason may be that the concept of introducing ecodesign philosophies in new product development is daunting and the initial impetus for addressing these issues is lost as the project moves down through the company. This process needs to be effectively managed and communicated. The question is does the management of ecodesign strategies mean a change in current design management? Demody (1995) points out that the inclusion of environmental criteria into new product development processes should not require changes in the overall process. However, she also suggests that the integration of environmental criteria could cause problems because of the lack of environmental expertise of NPD teams; three specific management problems are identified:

- limited environmental expertise,
- senior management commitment,
- cross-functional co-operation (a wider team base).

A team working management approach to the design and development of environmentally responsible products encourages co-operation within the wider team base and between the team and external players. Demody's research (1995) identified three management styles in integrating environmental criteria to product design and development:

- internal environmental experts become part of the team,
- all existing members of the team are expected to be environmentally aware and skilled,
- external environmental specialists advise the team.

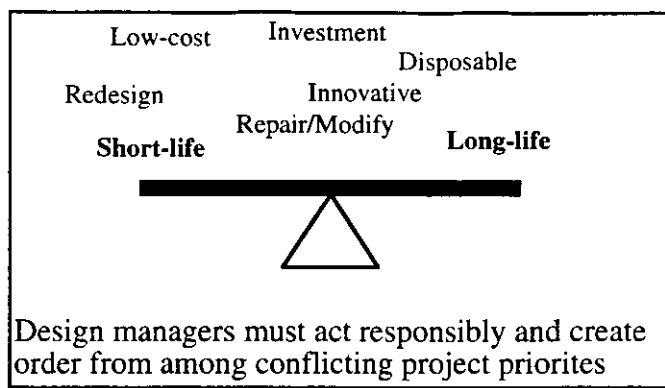
The results of the main research study showed that similar management approaches were being used in some of the companies and consultancies. In the architectural consultancy (CON001) an internal environmental unit (made up of a number of environmental experts) had been established to work with design teams on all the consultancy's design projects. In the telecommunications company (COM006) most of the design and development team were expected to become environmentally aware and skilled (although the management had not as yet established any formal training scheme). A furniture company (COM005) had brought in an environmental expert to assess the environmental impact of their products and processes. This resulted in the development of a strong relationship between the company and the expert and the expert was asked to carry out a comprehensive environmental audit on the whole company.

An example of 'extending' the team base which then has a detrimental effect on the integration of environmental criteria on product development, was demonstrated by an IT research company (COM001). This company had recently changed its marketing policy and so instead of developing a product concept and then trying to sell it, they had decided to find a suitable 'client partner' first before starting any design and development work. The result of this was a reduction in product development time, continual changes to the design brief up until, in some cases, the manufacturing stage, and a greater focus on 'redesigns' than on new innovation. The design and development process was effectively being compressed between the company's production schedule and the 'client partner's' changing product criteria. The designers in this particular company were very resistant to the idea of incorporating environmental criteria within design and development within that current system.

Charter (1992) points out that:

'senior management in different functions will need to be aware of their area's environmental performance and impact.' *'There will also be the need for greater co-operation and the development of more effective internal and external information systems and communication channels.'*

Here the concept of information and communication are key to successful senior management intervention. Walton (1991) sees the main issue as one of balancing (Figure 7.8); balancing competing and sometimes conflicting priorities. From a designer's perspective he sees that the term environmental 'responsibility' may imply unwanted rules, limitations and guidelines that reduce rather than expand the creative options. For managers it can imply the addition of decision-making criteria that diminish the viability of formerly profitable strategies.



Walton (1991)

Figure 7.8

Many of the issues of effective project planning, of corporate responsibility and corporate social responsibility have been integrated within Total Quality Management (TQM) by a number of multi-nationals, especially larger IT companies. This suggests that many of the difficulties associated with incorporating environmental criteria are more a matter of poor or inappropriate management than representing any distinctive difficulty in integrating environmental criteria in design and development. In companies using TQM there is now a strong correlation between the company's environmental action and its commitment to TQM. TQM provides a good working framework for the introduction of ecodesign philosophies at management and design levels. Sir Anthony Cleaver of IBM identifies the following factors as integral to TQM;

- Management commitment
- Training and awareness raising
- Accurate information gathering
- Assessing failure
- Concentration on prevention rather than cure

For the successful integration of ecodesign practice within design-based industry it is imperative that the opportunity for information gathering and giving is not focused on the higher echelons of the management structure, but given priority at all levels within the company and within the supply chain. As Charter (1992) points out, fundamental to the greening process is the acceptance that both organisations and individuals have a major role to play in social and environmental change and transformation. That is to say that it is equally important for designers to take responsibility for their own actions in addition to the responsibility taken by design management and senior management.

New demands will be placed upon the design team as a result of incorporating environmental, social and ethical issues into the design process. Mackenzie (1995) addresses these demands in the following:

- **Issue awareness:** Understanding the complex environmental agenda, either directly, or through expert advice. Understanding environmental priorities.
- **Interpretation:** Ability to relate the environmental impact of design decisions to the issues.
- **Guidance:** Ability to access and understand reliable sources of advice and data.
- **Application:** Ability to apply this advice with imagination and skill to the design task, recognising the inter-connectedness of design decisions.

Green and McMeekin (1994) argue that the environmental agenda is here to stay,

'The likelihood is that all companies that seek competitive leadership will have to build the environmental agenda into their priorities, even if they are not seeking to be environmental leaders.'

They go on to say that there is no one best model for incorporating the new environmental agenda into management priorities and, even in the cases where environmental issues seem to be most deeply-rooted in management decision making processes, there are limitations to how environmental priorities are embodied in research and development strategy. An indicator of this is the absence of R&D related topics covered in many environmental policies.

The problems of managing ecodesign should be addressed as part of best practice management systems. It is the absence of such systems that is the main barrier to effective ecodesign practice and not the specific requirements of the ecodesign process. Design must be prioritised by senior management so that long-term design decisions can be integrated within the overall company strategy; a strategy that includes environmental, social and ethical perspectives.

7.5 Communication networks within the 'green' company

The previous section has discussed the management of ecodesign where ecodesign does not require a different management system but one which is based on best practice design management i.e., where senior management, design management and designers have 'open' communication channels and opportunities for feedback. Both within the internal structure of the company and the external relationships of the company, the research findings have identified communication and the transparency of information as key requirements to successfully implementing environmental (design) strategies.

The internal communication channels are shown in Figure 7.9; including current communication mechanisms and envisaged future communication channels (see key).

Design is described in existing structures to be 'detached' from management and strategic decision making. The 'designer' has been used as an example of an individual or group

within the company involved with the day to day running of design decisions. The designer or design team is predominantly concerned with their own interest and the design work; for example, the design project, the suppliers, the manufacturing process. Intervention does not go beyond this level to include the company policy or company vision; these are the focus of senior management alone.

The internal ‘dynamics’ within a company structure

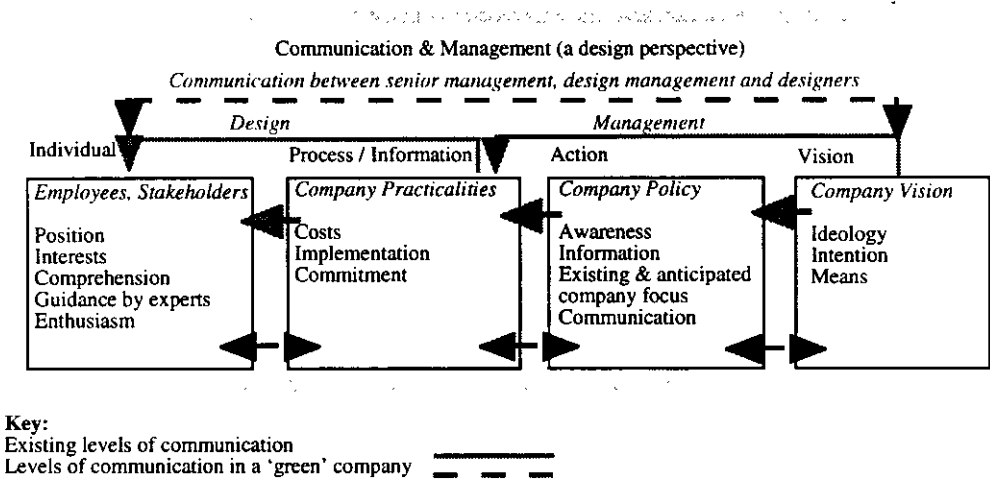


Figure 7.9

In the ‘revised system’, (indicated by the darker arrows), it can be seen that communication between the individual (employee, stakeholder) and the senior management is more direct and thus the former has a greater input into the longer-term vision of the company. In this context, design, as an example, is given greater credence by senior management; it is involved in direct communication and cross-fertilisation of ideas and the opportunities for effective ecodesign practice are greatly increased.

Figure 7.10 focuses on design communication networks within a ‘greener’ company structure. The design and development team has a ‘wider’ base from which to draw information and ideas. From an environmental perspective, environmental management and environmental experts (who could be internal or external to company) are fully integrated within the design and development decision making process. The senior company management, which takes account of parent company goals (where applicable), stakeholder and community views, feeds directly into the design and development team, probably through the channels of design management and environmental management. This ‘direct’ communication lessens the possibility of mis-understandings regarding design direction and design project developments and opens the way to a greater understanding within the company structure of the impact that design decision making has on the life cycle environmental impacts of products developed by the company.

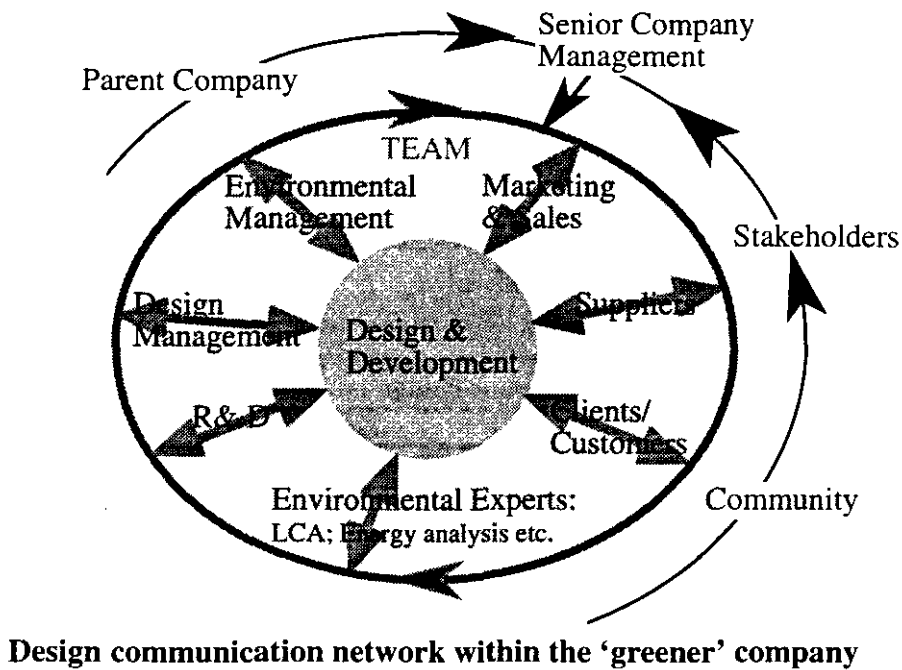
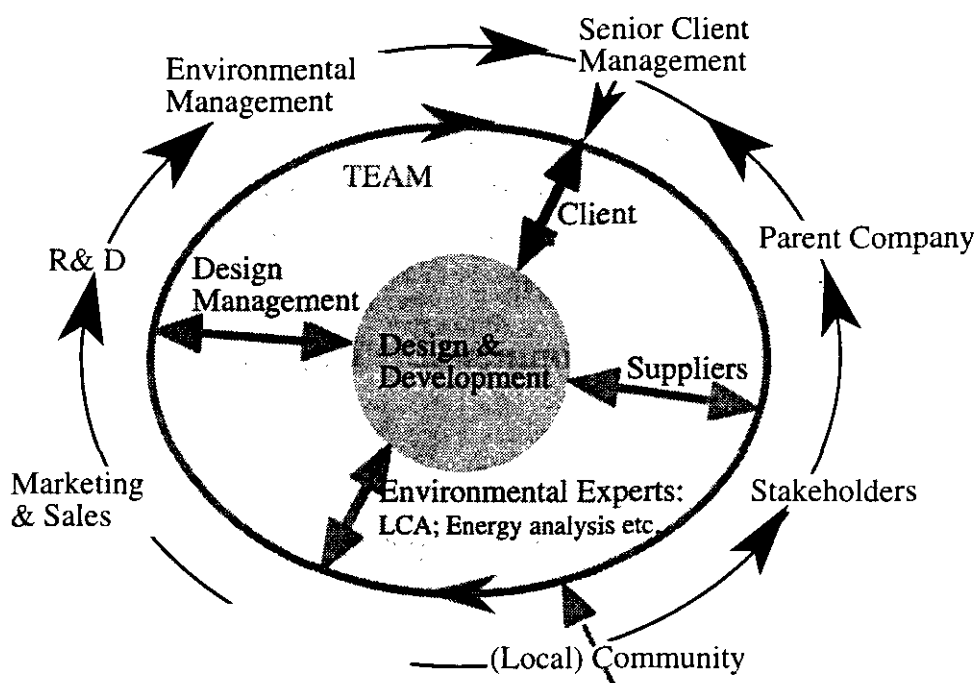


Figure 7.10

A similar view of a design communication network within a 'greener' design consultancy is presented in Figure 7.11. The difference here is that many of the 'disciplines' found in a greener company design and development team are external to the consultancy design and development team. The client representative is the key connecting factor between the client product development decision process and the consultancy's design and development team. Apart from this client contact the design consultancy team is 'alienated' from the company's main design decision making processes.



Design communication network within the 'greener' design consultancy

Figure 7.11

The main research findings identified a number of reasons why consultancies were generally not being pro-active in taking an environmental stance within design:

- The majority of companies (clients) are larger in size than the design consultancies and thus companies tend to have a formulated (environmental) business policy regarding product development which they 'impose' on the consultancy. It would take an environmentally knowledgeable consultancy to counteract a client's policy with their own; consultancies generally do not operate around any formal business policies,
- Companies have a greater multi-disciplinary base to draw on to formulate (environmental) decisions regarding product development; consultancies usually consist of trained designers (the management are usually design trained as well) and administration staff - very few have access to environmental expertise,
- Companies tend to communicate to the upper level of the supply chain (the market, stakeholders) whereas design consultancies have strong links to the 'raw materials' supply end. In past years greater pressure for taking an environmental perspective has come from the retail end as opposed to the raw materials end, and therefore companies have had more pressure on them to be more environmentally responsible.

The ‘greener’ business concept of ‘different’ communication networks is echoed throughout the supply chain and other external influences such as the local (national, international) community and the parent company (as illustrated in Figures 7.5, 7.9, 7.10, 7.11). Increased communication and transparency of information regarding company aims, objectives, future projects and problems between all these elements should lead to a more environmentally, socially and ethically responsible business system.

7.6 The hierarchy of environmentally responsible design strategies

The concept of ‘greener’ business communication systems mapped out in Figures 7.10 and 7.11 do require a major rethinking of current business practice. In this sense the move from ecodesign towards sustainable design is being considered. Table 7.1 shows a hierarchy of environmentally responsible design initiatives (Dewberry 1996). The concept of the hierarchy approach is not a new one; Dauncey (1995) developed *seven steps towards company greening* ; Potter & Roy (1994) developed a green company typology; and Green and McMeekin (1994) present an overview of a number of different strategic levels of company greening, as does Roome (1992).

Table 7.1 covers the range of attitudes from the cynical, reactive approach to that of a very proactive and sustainable approach to design. In-between these we have concepts such as ‘clean-up’, ‘market-led’, ‘green’ and ‘eco’ design. Each ‘type’ of design is a result of a variety of different drivers and a particular company ‘environmental’ strategy. For example, a market-led approach to environmentally responsible design is the result of the company acknowledging a perceived commercial opportunity to promote their product as more environmentally benign than others on the market. This type of approach was common in the marketing of detergents and other cleaning fluids in the early 1990’s and eventually resulted in bad publicity for a number of companies through the *Green Con Awards* and media attention.

The two initiatives described in Table 7.1, ‘top-down’ and ‘bottom-up’ refer to the level in the company at which environmental action was initiated. For example, the main research findings provided a number of examples, such as in COM004, COM006 and CON011, where environmental action publicised by a company had been the result of the efforts of an environmental champion within the company (bottom-up) and not as a result of strategic action by the company (top-down).

The research findings show that each type of environmentally responsible design approach tends to have a particular initiative associated with it. Those companies who have implemented environmentally responsible design strategies because of the legislative requirement to *clean up* their manufacturing process or eliminate certain materials from their

products, have generally been directed to do so as a result of a senior management (top-down) initiative to meet legislative standards. Green design on the other hand is often the result of an individual realising the potential financial savings of material recovery or alternative material purchasing in-house. For example, COM004 illustrated this point by advertising an initiative to include recycled plastic within their computer keyboards. It turned out that this waste was recovered pre-consumer waste from the factory floor and that the initiative had been the brainchild of an employee based in the manufacturing department of the company.

Relating Environmentally Responsible Design Approaches to Company Initiatives

Type of Approach	Company Strategy, Action & Main Drivers	Initiatives
Sustainable Design - Design systems within and between companies their communities and other communities	Systems based design approach. Building on from ecodesign awareness to address more 'global' issues such as ethics, cultural & development issues. Impossible to address as a sole organisation and must be approached by industry and society as a whole. A political agenda - government led.	Top-Down & Bottom-Up (Agenda 21)
EcoDesign - Awareness of environmental impacts over whole lifecycle - from production through to disposal.	A focus on company systems at all levels. Input from a strategic level with comprehensive aims and objectives. Environmental impacts addressed across the whole life-cycle of product and company action. Integrated within company philosophy - not an 'add-on'.	Predominately Top-Down
'Green' Design - Single environmental issues focusing on the product - incremental changes.	A product focus. Concentrated on a single environmental issue, not necessarily the greatest environmental impact issue for that product. Often the result of individual action - the 'environmental champion' within a company or the company's reaction to legislation or market pressures. Not dealt with comprehensively at a strategic level.	Predominately Bottom-Up
'Good Housekeeping' - An energy and material resource focus - opportunities for employee 'action' schemes	Management introduce office waste recycling schemes, effective energy use of process equipment, opportunities for savings within the workplace. Always COST driven and sometimes marketed as environmental company action. Sometimes implemented in response to employee pressure for action.	Top-Down & Bottom-Up
Clean Up Initiatives - Generally process orientated. Management response to existing or forthcoming legislation.	End-of-pipe solutions to company environmental problems. Focus is on the process and emissions of pollutants. Usually action is driven by legislation or by publicity of bad practices. Investment is required.	
Market -Led Initiatives - Product focus - lip service paid to environmental issues. Used solely for commercial advantage.	Window of commercial opportunity acknowledged. Product is tweaked, in most cases 'repackaged' to insinuate some form of environmental benefit - extremely short-term outlook. Past history of this has led to customers now dubious about any 'green' claims. Profit is the bottom line.	Top-Down
No Initiative - Cynical about current environmental concern. Would rather wait until forced into action	Company is cynical about environmental concern. Sees it as a marketing ploy and is convinced of added costs to implement environmental initiatives. Refuses to act unless forced to by legislation. Extremely defensive - 'head-in-sand' syndrome.	

Dewberry (1996)

Table 7.1

As this research project has illustrated, many companies to date have mainly been focusing on 'green' design initiatives; design that focus on one or maybe two environmental impacts where those impacts may or may not be the main environmental impacts of the product being (re)designed. Drivers behind such action have been predominantly reactive and relatively 'ad-hoc' in terms of the method by which they have been introduced into the company and design process. The need for greater amounts of accurate and comprehensive information is

imperative if future ‘ecodesign’ initiatives are to be an integral part of the UK design-based industry.

Table 7.2 plots each company and design consultancy involved in the main research study on the environmentally responsible design approach hierarchy. A range of approaches to environmentally responsible design are represented by this sample

A plot of the company and design consultancy approaches to environmentally responsible design

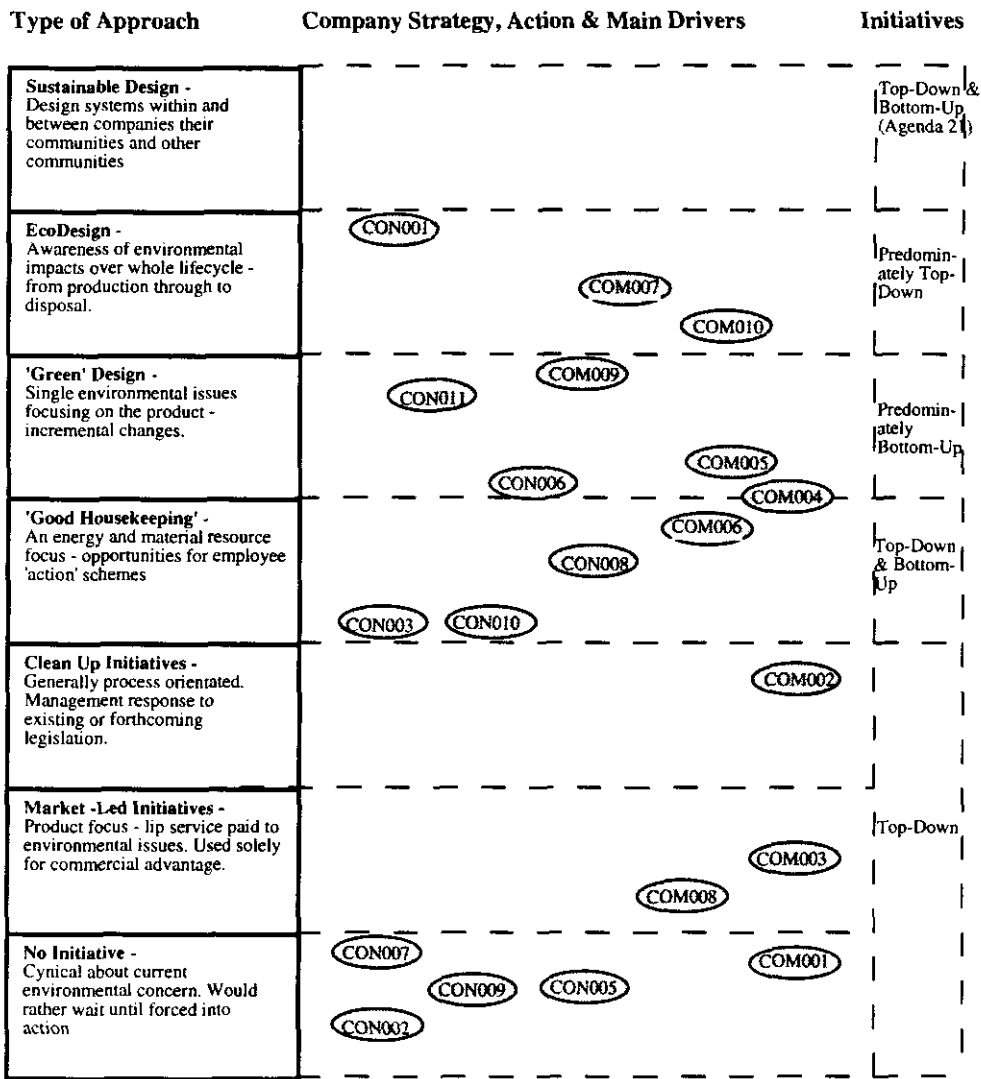


Table 7.2

More consultancies than companies had no environmentally responsible design approach and more companies than consultancies were moving towards a comprehensive ecodesign approach. None of the respondents at reached a ‘sustainable design’ level, but this is not surprising as it requires a complete rethinking of priorities. Ecodesign approaches on the other hand can be applied to any product or service. The majority of consultancies and companies represented good housekeeping and green design approaches where cost savings

are the dominant driver force in the former approach and a single environmental issue focus is the main concern of the latter approach.

7.7 Conclusions

- **the current state-of-the-art regarding UK designers' attitudes to integrating ecodesign within design and development processes**

Summary of findings:

- generally reactive;
- confused, not directed;
- an empathy with the natural environment but little understanding of environmental issues;
- frustrated / cynical;
- a question of coping with clients / management - the designer's lack of power to 'champion change'.

- **Opportunities and constraints for integrating ecodesign criteria from a design perspective**

Summary of findings:-

- from a consultancy perspective clients are generally seen as a constraint;
- lack of time seen as a barrier - design time was often decreasing: as a result of *just in time* management approaches or as a result of cost reasons to finish project;
- cost savings as a result of integrating environmental criteria within the design process was seen as an opportunity for continuing ecodesign initiatives;
- including environmental criteria within the design brief increases the challenge for the designer and therefore encourages a greater degree of creativity.

- **Information requirements for designers**

Summary of findings:-

- new information is required for effective ecodesign practice;
- information needs to be specific, focused and applicable;
- information needs to be presented in an understandable format for a wide audience;
- information needs to be easily accessible, maybe through a central UK unit;
- a need for 'hands on' information; a sharing of relevant information within the design community.

- **the positioning of ecodesign within the company and the supply chain structures**

Summary of findings:-

- ecodesign is not prioritised by management;
- designers (often including design management) are generally not involved in the strategic decision making process with regard to product development;
- in-house designers communicate with suppliers but not customers; design consultants tend to communicate with both suppliers and customers (clients);
- there is a lack of communication between management, design and suppliers which results in a gap between environmental policy and environmental practice.

Chapter Eight addresses the concept of design that resides in a business and social system based on more sustainable ideals. The question for the design profession is how to move from a green design or ecodesign level to a sustainable design level? This final chapter discusses the concept of sustainability and how the design profession can move towards acknowledging a wider context in which to practice design.

ECODESIGN

Chapter 8

Steps towards sustainable design; Directions for future research

'Industrial design is in a crisis. Whether it recognises it or not, it is in a crisis of identity, purpose, responsibility, and meaning that has largely gone uncommented upon by the practising community, a fact that is, or should be, disturbing in itself. The viability of the profession as it is currently practised needs to be seriously questioned, it's boundaries examined, and its values reconsidered.'

Adam Richardson (1993)

'In many ways, the environmental crisis is a design crisis. It is a consequence of how things are made, buildings are constructed, and landscapes are used. Design manifests culture, and culture rests firmly on the foundation of what we believe to be true about the world. ... It is clear that we have not given design a rich enough context. We have used design cleverly in the service of narrowly defined human interests but have neglected its relationship with our fellow creatures. Such myopic design cannot fail to degrade the living world, and, by extension, our own health.'

van der Ryn & Cowan (1996)

8.1 Introduction

This final chapter aims to identify the steps that need to be taken in order for design-based industry to move towards a more sustainable ideal; this process focuses on the designer's role within industry, the responsibility of designers and the scope of future design direction.

The chapter concludes with an overview of possible future research directions which would enable a greater understanding of ecodesign processes, environmentally responsible (design) management and concepts of achieving a sustainable design ethic.

8.2 Steps towards Sustainable Design

This research has illustrated that, at an independent level within current industrial practices, designers have the ability to produce 'greener' design solutions; these may focus on material resource solutions such as using recyclable or recycled materials, or addressing material compatibility for disassembly purposes, or considering the minimisation of material use within the design. This type of design action has been the focus for the majority of 'greener'

designs produced by industry to date. This focus does not require a long-term strategic design plan, nor does it ask searching questions of the designer that requires vast amounts of new information or a change in the 'business as usual' approach. The benefits are cost based and in most cases, market or legislative driven. The integration of environmental criteria within the design process at this level does not encourage a re-evaluation of the overall point and direction of product design development.

A few of the global design-based companies and even fewer 'forward thinking' UK design consultancies are now considering environmental impacts of a design from an ecodesign life-cycle perspective (see Chapter Two, 2.6.3). Such initiatives are rare. This is primarily due to *reactions to 'change'* (i.e., changing from a business as usual approach) and concerns regarding '*risk*', which are both cost and 'image' based. The concepts of change and risk are central to re-evaluating design towards a complete life-cycle awareness. This involves a strategic management input, longer-term business goals, transparency of information and increased levels of communication within the company and between those involved in the supply chain. These changes evoke concerns of increased financial investment and commercial vulnerability from the majority of industry, but from those in the process of implementing change, the focus is very much on long term competitiveness within the increasing global market.

This strategic, life-cycle approach to design empowers designers to address the true environmental impacts of their designs effectively, at the design and development stage. At this stage designs are planned at a level of environmental awareness that eliminates the need for 'end of pipe' solutions and 'add on' environmental modifications to existing product lines. Ecodesign revolves around a systematic design approach where initial design intervention encourages a minimisation of a product's life-cycle environmental impacts. Such design thinking can be implemented within the existing model of economic and social development.

Sustainable design cannot be practised in this existing model of development as it requires a greater sensitivity to the social, ethical and ecological issues impacting on the world today (see Chapter Two, 2.6.4; 2.7). It pertains to a view that questions the current value system and encourages an alternative design ethic based on revised understanding of what design entails and where the future of design lies. In this sense, sustainable design moves beyond the existing boundaries of the design process to address fundamental questions regarding cultural development, the ecosystem (of which humankind is but a part) and the global development trends which will increasingly rely on balance and understanding. It is therefore extremely difficult, if not impossible, for designers to practice a 'sustainable' design approach within the current commercial system. The concept of sustainability relies on both top-down (e.g. government policy agreements) and bottom-up (e.g. Local Agenda 21 action) initiatives. However, for sustainable design to be a reality on an 'industrial'

level, top-down initiatives will be the main initial drivers in influencing a different socio-economic global perspective. For example, top-down initiatives such as: global validation schemes for raw materials; transparency of global environmental information; cross-fertilisation of ideas within industry sectors; concepts of 'working together' as opposed to 'working competitively against one another'; and global environmental accounting. In summary, sustainable design is only a small part of a large change in global perspectives on all levels - it is part of a socio-political solution to decreasing overall environmental impacts on a delicate ecosystem. This obviously requires a massive change in people's perceptions of what constitutes wealth, happiness, security etc., and indeed, it is no task for a relatively small design profession,

..... But design does have the ability to challenge the status quo and contribute to socio-political moves in *the direction of* sustainability.

8.2.1 Designer Responsibility

The designers' responsibility is primarily to be aware of the impact that their designs have on society, on culture and on the ecosystem. The responsibility of the designer, as a part of the industrial system, is to question key environmental issues that relate to their role in that system, for example, the continual over-production of (worthless / disposable) products and understand the limitations of this approach in design. The profession has a responsibility to the successful future of design and to re-evaluate the core messages that design is currently communicating globally; here the sign of human success is reflected in purchasing an array of objects that raise the status of the individual; our culture seems detached from its roots; the concept of 'inner self', of harmony, of respect for nature has been lost in the myriad of consumer products and consumer ideals. This perspective is far from sustainable and design solutions need to address the fundamental building blocks of what the 'designed' object is, what it stands for, and what the future has in store for it.

'We have sacrificed the harmonious development of our own cultures for enormous short-term gains, and now we face the invoice for that kind of thinking: an ecological and social crisis whose origins lie deep within the assumptions of our commercial and economic system. The compelling nature of this crisis, however, is its evolutionary nature. The array of choices and problems that face us do not call for a global triage, the further dislocation of cultures, or the division of nations. They are soluble by design, and the basis of that design rests within nature.'

'... a critical basis for change and consensus is to find a way to introduce and discuss ecological principles in society in a manner that draws people together, rather than repelling or deterring them. This step is crucial, because within ecological principles reside not only the problems and challenges that face us, but also the solutions that can be used to transform our economy and society. Confusion or ignorance about these principles will not provide us comfort or protection from their implications.'

Paul Hawken (1993)

Although Hawken suggests that the global problems facing late twentieth century society 'are soluble by design', it is clear from the empirical work of this research study that this is

not the case. In an ideal situation, the innovative nature and creativity of a design profession may well produce inspired solutions to the problems associated with an ever expanding consumption and production system. However, we do not exist in an 'ideal' context and designers have to balance inspired creativeness with the realities and constraints of a commercial world. As many of the case studies showed, there are many barriers as well as opportunities for integrating environmentally responsible design strategies. Unfortunately many of these 'opportunities' within the commercial arena, (i.e., commercial pressures, anticipated legislation, cost saving exercises), are out of designers' hands.

8.2.2 Design education: the potential role of the designer

The designer can have a key position to play in encouraging the move towards sustainability within the industrial sector. By asking the right questions of management, marketing, suppliers and co-members of the design team, designers have a central role to play in changing the existing philosophy where cost and convenience are optimum and where environmental considerations are marginalised.

There is a good case for believing that the influence designers may have on a project must not be underestimated by management. This is because those individuals who have been trained to think in a lateral way will encourage a re-evaluation of existing product directions in the context of sustainability. This is however dependent on design education bridging an ever widening gap between designers and the natural environment; designer educators need to review design curricula to move away from a focus on the existing 'technology and machine' concepts of design towards a new focus for (product) design that starts to evaluate the environmental impacts of 'designing' and encourages a greater understanding of the complexity and diversity of nature's design. This shift in emphasis within design education will result in a new level of designer who is aware of the impact of design decisions, and recognises the potential of design to be innovative and creative as opposed to current design which tends to react to consumer (commercial) demands. Such a shift in design education requires a shift in perspective within the socio-political system. Therefore, at the present time, design education can only hope to encourage young designers in being aware of *ecological* issues and of the impacts their designs have on society and the environment by educating them on the technical opportunities and the possibilities for creative solutions to environmental problems.

Design problems that question the scope of existing possibilities in design, such as designing buildings that produce their own energy or recycle their own wastes, or products whose materials can be completely reclaimed or made from the waste of other processes - problems such as these bridge conventional scientific and design disciplines. It is imperative that this perspective of design is addressed within design education in order that designers are aware and knowledgeable of the issues facing an unsustainable economy. The design role is to ask questions; questions that make individuals stop and think and consider the

consequences of their action. Designers need to be educated to understand a broader context of issues than those currently addressed within design curricula.

' philosophy, ethics, economics, the social sciences or even design history few designers are aware that these fields have any bearing on the profession, or if they are, they take little action to implement their knowledge. An ethic of industrial design solely needs to be defined and developed and not left in its current nebulous state. The correction of this deficiency will take time. Likewise, so will the recognition that designers should be present at the very conception of the product and the re-evaluation by designers of their roles in the process of "form follows function" . While the implementation of solutions to the current crisis of industrial design will be experimental, even problematic, such reassessment is imperative, for the path that industrial design is currently following leads only to its bastardisation.'

Richardson (1993)

Designers are ultimately communicators; they have the opportunities to communicate information to an extremely wide audience - in some cases, a global audience. This is a key issue which can be utilised by designers to encourage a more environmentally responsible attitude, although it is a fact that such messages can be beneficial or damaging (for example, the backlash on the 'greening' of products because of false messages of the environmentally friendliness of some products).

In the present system the impact of design and the subsequent messages that are communicated are not addressed at the design stage or in fact, at any stage of the development and production process. There is a need for a different emphasis in design so that the inter-connectedness of design thinking, design action, production and consumption, ecological and cultural devastation can be fully understood. Unless this happens then the designer will have a minimal role in encouraging a more sustainable existence.

Manzini (1993) highlights the lack of design culture in today's society where commercial competition has encouraged the utilisation of new technologies in creating the 'new and exciting' and has resulted in the proliferation of worthless products. He promotes the concept of all design activity relating to the wider network of relationships throughout the design's life-cycle but recognises the enormous growth in the complexity of the system in which both design producer and consumer must interact.

'Going in this direction requires the development of a new product culture, a culture that radically questions how the existing culture fits into our environment and how it relates to the fruitful subject [of environmental limits].'

Manzini (1992)

8.2.3 The Scope and Direction of the Future Design; a new context

'Thus what is required today is to imagine innovative solutions with a high level of radicalism (containing some kind of hypothetical response to the problems at hand), proposing alternative paths to those of the past and present. the aim is not to find "the solution" for all questions: the idea, more modestly, is to propose solutions which contain some spark of innovation, meaning and a way of behaving or of viewing the world.'

Manzini (1994)

Sim van der Ryn and Stuart Cowan in their book *Ecological Design*, remind the reader that there are three critical strategies for 'ecological' or 'sustainable' design; conservation, regeneration and stewardship. A combination of all three strategies focus on the technical and personal dimensions of sustainability and together, encourage new kinds of creative endeavour while acknowledging the need for limits within the global system, i.e. the concept of sustainability.

Sustainability is a popular but mis-used concept. Commonly recognised definitions such as the Brundtland definition of sustainability¹ - can be interpreted at many levels, most of which do not present clear and defined guidelines encouraging a coherent move towards a more sustainable existence. Orr (1992) suggests that there are in fact two approaches to sustainability; technological and ecological.

Technological Sustainability

Here every problem has either a technological answer or a market solution. This approach to sustainability is about expert interventions, high profile international agreements and sophisticated management techniques and depends for example, on:

- more rapid economic growth in both industrial and developing countries
- freer market access for the products of developing countries
- lower interest rates
- greater technology transfer - better management of technology
- significantly larger capital flows.

Ecological Sustainability

Embraces very different assumptions from the 'business as usual' approach. This approach to sustainability requires limits to technology, limits to material wants, limits to stress placed on the biosphere and limits to hubris:-

- people are finite and fallible
- a sustainable world can be redesigned and rebuilt only from the *bottom up*
Note: Orr suggests that a complete 'overhaul' of human values is required which must come from the people (bottom-up). However, in reality, such an overhaul would be impossible and therefore the author suggests that directives from the top-down are also required to move towards a more 'sustainable' world.
- traditional knowledge that co-evolves out of culture and place is a critical asset
- the free harvest of evolution is encoded in nature's design.

Figure 8.1, shows Riddell's (1981) view of political ecology - the connections between mankind, the biosphere and the development system. The 'black box' development system identifies 'top-down' direction as the primary focus for the management of the system where government and other power blocs develop policies that impact directly on the rate of resource consumption, the level of development, planning and trade and so on.

¹ **Brundtland definition of sustainable development:**

development that meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development 1987)

Consumption and prosperity are shown as outputs from positive development; this is generally true for Western countries, but for developing countries the reality is one of reduced per capita consumption and increased austerity. This description of consumption as an output of positive development is based on a system where the resources of the biosphere are not costed into the development equation. If they were accounted for then consumption, on a level that currently exists, would not be viewed as an output of *positive* development but as an output of *unsustainable* development.

Political Ecology: Man, Land and Development (Riddell 1981)

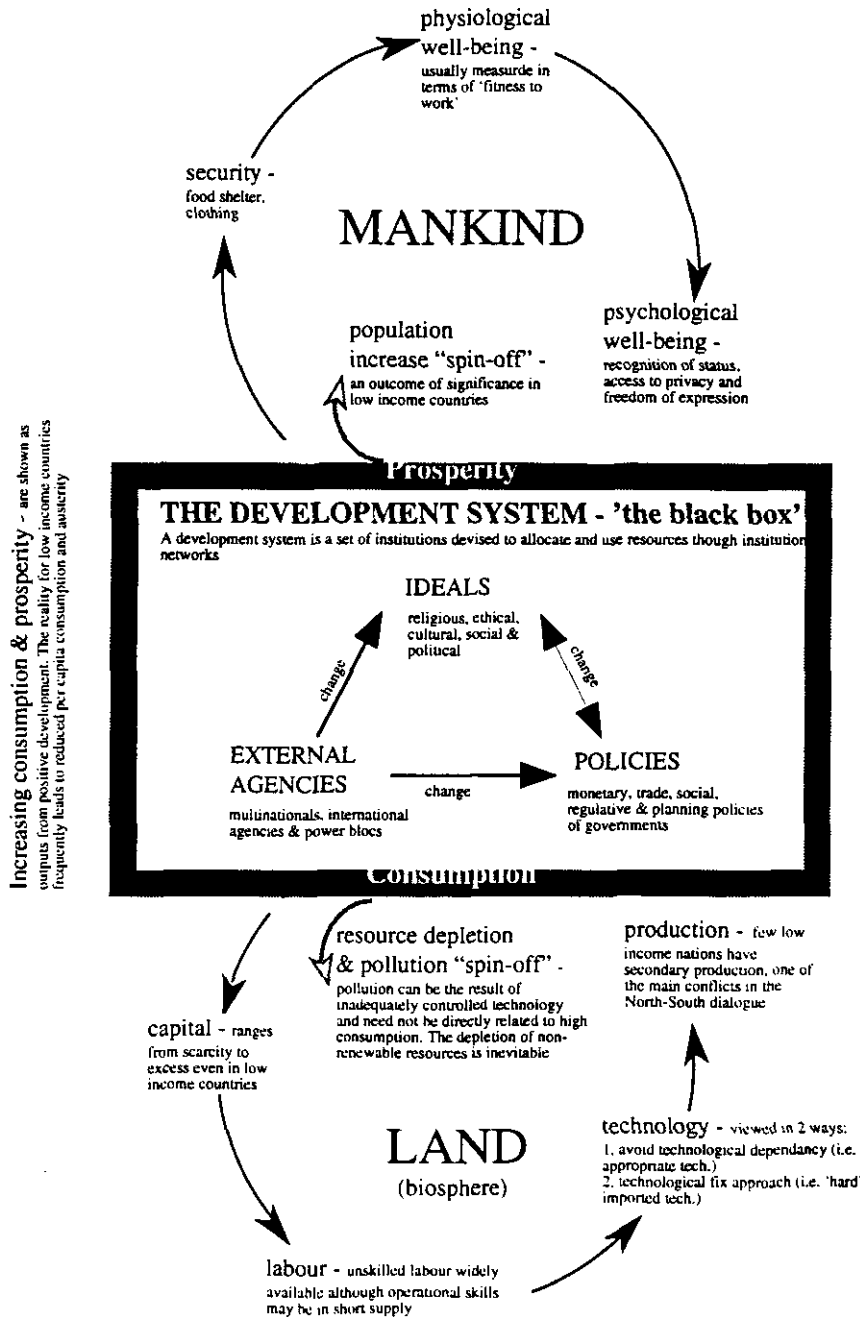


Figure 8.1

There are a number of elements from Figure 8.1 that can be addressed through a sustainable design approach:

Issues related to the biosphere:	over-consumption, (people want to gain control over their lives); excessive resource depletion and pollution; 'hard' technology focus of the industrialised nations.
Issues related to mankind	prosperity related to 'material' wealth; psychological well-being determined by external factors (status) rather than internal feelings (spiritual); increasing gap between the security of the 'haves' and 'have nots'.

Although sustainable design can begin to question the rationale behind many of these issues (as can any other 'discipline' or individual), it is important to note that the existing problems associated with these issues cannot be solved by design, all of the problems are associated with the current 'development system' which, as Riddell points out, are driven solely by top-down policies and initiatives. For example, in terms of natural resource depletion and population growth, he expresses the consequences for the future as:

$$\frac{\text{ever depleting non-renewable resources}}{\text{ever expanding population}} = \text{increasing austerity}$$

He suggests that solutions to this problem are two-fold:

- (a) to limit future population and
- (b) to attain a sufficient material existence for those living

These 'solutions' require a major revision in the economic development goals of governments globally and are therefore way beyond the remit of the designer.

The question for the design profession, and indeed, industry and society as a whole, is how does one begin to move towards a more sustainable ideal? What are the initial steps in moving away from a technologically focused paradigm to one more centred and connected to ecology and a sustainable future. Van der Ryn and Cowan (1996) present five principles for sustainable design:-

Principle 1. Design is grounded in the details of the place. It is small scale and direct, responsive to both local conditions and local people. Asks questions such as,

- what is here?
- what will nature permit us to do here?
- what will nature help us to do here?

Principle 2. Provides the criteria for evaluating impacts of a given design. Ecological accounting informs design - the environmental impacts of existing or proposed designs are traced and this information is then used to determine the most sustainably sound design philosophy.

Principle 3. Suggests that these impacts can be minimised by a working partnership with nature. By working with living processes we respect the needs of all species while meeting our own.

Principle 4 implies that sustainable design is the work not just for experts, but for entire communities - no one is a participant only or a designer only. Everyone is participant-designer and therefore acknowledge individual knowledge and experience.

Principle 5 supports the concept that sustainable design transform awareness by providing ongoing possibilities for learning and participation. Effective design helps inform us of our place within nature.

The future of design as an influencing and informed area will be dependent on the integration of ecological principles and a sustainable perspective within current design practices and design attitudes. Richardson (1993) suggests that the viability of the current design profession needs to be seriously questioned, it's boundaries examined and it's values reconsidered. The questions he poses are,

- What is the remit of current design practices - i.e. where does design end and engineering intervention begin? (is it a single continuum with artificially imposed categories?)
- What are the impacts of design's products in societal and cultural contexts?
- Are these impacts important?

The designer, as an individual or within a design team, has an influence on the end result of a design project; the 'designed' product. However, the level of this influence is dependent upon a number of other criteria namely; the priority given to design within the context of the business system; the integrity and awareness of the individual designer; the relationship between the designer and other elements in the design and development process; the ultimate priorities of the business in which the designer operates.

So, in many respects, the barriers to achieving a more sustainable design ethic are those imposed by the business, societal and cultural systems. For example we live in a system which encourages consumerism and therefore, within the commercial arena, design is asked to focus on the design and development of numerous products, many of which are 'redesigns' and modifications in order that the product can be updated in terms of it's 'style and image'. Who influences whom in this circle of manufacturer - consumer- culture is extremely difficult to fathom out, but one thing that seems certain is that this pattern of consumption must alter for sustainable concepts to become more mainstream.

The 'breaking' of this consumption pattern may be aided by increasing the awareness of the individual and encouraging the wider community to promote a more sustainable lifestyle.

The Dutch Environment Ministry held a workshop to propose strategies and specific action to encourage sustainability within lifestyles. The following represents the guidelines devised at this workshop.

Proposed Dutch guidelines to promote sustainable lifestyle change

- Re-discover enjoyment of non-material aspects of life, for example, by the commercial marketing of sustainable lifestyles
- Meet household needs with services instead of individually owned products
- Increase and emphasis the social value of leisure and personal care time, for example, through flexitime working arrangements and working from home
- Increase availability of and access to information, for example through "right to know" legislation product labelling
- Networking, education and empowerment, for example, in schools, purchasing co-operatives, green mail-order catalogues and tele-networking.

ENDS (1995)

8.3 Concluding comments on sustainable design

As Manzini (1994) points out,

'Design certainly cannot change the world nor can it design lifestyles (imposing ways of acting on people in keeping with intentions). But design can "give form" to a changing world, and "offer opportunities" for new types of behaviour.'

The first step towards sustainable design is for the design profession, design educators and the system in which design operates, to recognise the potential of design in solving environmental problems. It is the responsibility of these groups to address these evolving issues within design before design buries itself in the proliferation of increasingly useless products that is the legacy of the 'adolescent' years of design, the legacy of the latter half of the twentieth century. It is time for design to move into it's 'twenties', to deal with the consequences of its action rather than sweeping those consequences under the carpet, to be radical, to push the boundaries, to learn from the past and have confidence in the future. It is time for design to grow up, acknowledge its responsibilities, recognise its limitations and respond to the problems posed with creativity, with integrity and with insight.

8.4 Recommendations for further research

The scope for further research into ecodesign and related areas is considerable.

This research study has produced an overview of a selection of UK designers' attitudes to integrating environmental criteria within design and development. It has focused on UK ecodesign initiatives and has attempted to understand something of the barriers and opportunities, information needs and communication blocks, currently present in the process of implementing ecodesign criteria.

8.4.1 The manufacturing perspective; supply chain relationships

Case studies and further observational research will continue to be important in analysing the inclusion of environmental criteria within the business system. Specific, generic and global information requirements need to be assessed through a series of research projects focusing on all elements of the business process.

Valuable research might be the analysis of supply chain dynamics within 'best' or better' environmental practice companies - there is an emerging concept that the whole supply chain will need to take greater responsibility for its actions, encouraging stronger and long-term relationships between the players in the chain. Research of this nature could highlight key guidelines regarding communication, networking and information requirements within and between the individual components of the supply chain. Such information would be vital for the integration of comprehensive ecodesign strategies where data can be validated from the production of the product through to its eventual disposal.

8.4.2 Consumer attitude; changes in lifestyle

Moving away from the manufacturing end of the supply chain there are opportunities to focus on consumer attitudes in relation to design - fashion, trends, culture. Research to date has tended to focus on the responsibility of the manufacturer or political system to alleviate the environmental ills of our time. From an opposite perspective, research might address the drivers behind purchases; the desires and the needs of consumers within society and focus on issues such as 'status' through consuming; advertising and communication; changing lifestyle attitudes; identifying 'acceptable' influences within the consumption - production cycle that encourage moves towards more sustainable lifestyles.

8.4.3 Ecodesign Strategies

Within current industrial practice, 'top-down' environmental management approaches are seen as an effective way of 'greening' the business system. From a design and development

perspective, it would be interesting to ascertain the level of involvement of designers in developing strategic product development decisions and carry out participant observational research in this area. The management of design is a key area which needs to be re-addressed for ecodesign strategies to be implemented effectively.

Van der Ryn and Cowan (1996) suggest that ecological design can only be achieved through 'bottom-up' approaches. A study comprising of those designers practising at this level would be useful in ascertaining the barriers and opportunities these individuals, as practising ecodesigners, recognise in implementing their philosophies. Such a study would inevitably add to the debate on 'where design goes from here'?

The field of ecodesign is new and challenging. Research to date has tended to 'set the scene' and has prioritised concerns that are now affecting or are soon about to affect the global system (ecosystem). Future challenges will encompass a wide range of inter-related areas of research and these will no doubt reflect the inter-disciplinary nature of ecodesign.

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Appendices

- Appendix 1A: Design consultancy pilot study postal questionnaire
- Appendix 1B: Design-based manufacturing companies pilot study telephone questionnaire
- Appendix 1C: Main in-depth interview study semi-structured questionnaire

U.K. DESIGN CONSULTANCY QUESTIONNAIRE
05/93/ERDS01

Questionnaire Number

All information provided will be treated in the strictest confidence.

CONSULTANCY NAME

.....
ADDRESS

.....
TELEPHONE

.....
NAME OF RESPONDENT

.....
POSITION

1.1. Please indicate which area(s) of design your consultancy specialises in.

- | | |
|--|-----------------------------|
| <input type="checkbox"/> | Product |
| <input type="checkbox"/> | Engineering |
| <input type="checkbox"/> | Packaging |
| <input type="checkbox"/> | Graphics and Communications |
| <input type="checkbox"/> | Interior / Exhibition |
| <input type="checkbox"/> | Fashion / Textiles |

If the area is product / engineering / packaging design, please indicate the spectrum of products the consultancy deals with

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1.2. How many people are employed within the consultancy?

What number of these are directly involved in design work?

What number of these are professionally trained designers?

1.3. Does your consultancy have an interest in environmental issues?

☐

YES

☐

NO

1.4. Briefly explain what your company's understanding of *environmentally responsible design* is

.....

.....

.....

.....

.....

.....

.....

.....

1.5. Does your company feel that to achieve environmentally responsible design, (design that accounts for environmental impacts during all stages of a product life-cycle), the designer requires further information?

☐

YES

☐

NO

If Yes,

On what subjects is environmentally responsible design information required?

.....

.....

.....

.....

.....

.....

.....

1.6. Is your company aware of external environmental regulations that will affect the products your company designs?

For example:-

Legislation

☐

YES

☐

NO

Environmental issues impacting on business

☐

YES

☐

NO

Voluntary Guidelines	<input type="checkbox"/>	YES	<input type="checkbox"/>	NO
Other	<input type="checkbox"/>	YES	<input type="checkbox"/>	NO

If Yes, please state what these are and how your company was made aware of them

.....

.....

.....

.....

.....

.....

1.7. Which, if any, design consultancies and/or design sectors does your company deem to be the 'benchmarks' in terms of environmentally responsible design for the British Design Industry?

.....

.....

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.....

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.....

ENVIRONMENTAL POLICY

2.1. Does your consultancy have an environmental policy that has either been implemented or is in the process of being implemented?

<input type="checkbox"/>	YES	<input type="checkbox"/>	NO
--------------------------	-----	--------------------------	----

If Yes, please describe the main objectives of this policy

.....

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☐ YES ☐ NO

If No - Thank you for co-operating in this survey, please go on to the final page of the questionnaire (->).

☐ YES ☐ NO

[illegible][illegible]

.....

.....

.....

.....

.....

2.4. Rank in order of priority the five main reasons for your consultancy having, or considering having, an environmental policy (1 = highest priority, 5 = lowest priority)

Company Business Philosophy

Pressure from Clients (client's environmental policy)

Pressure from Employees

Legislation

Industry Association Policy

Marketing Advantage

Other (specify)

(->)

Please indicate whether you would be willing to be contacted again by the Design Innovation Group regarding this research study.

☐

YES

☐

NO

Please return this questionnaire in the enclosed prepaid envelope.

If possible it would be helpful if you could also send your company brochure and / or a recent annual report.

Thank you for your time.

Telephone Questionnaire

July 1993

Appendix 1B

For industry sectors:-

White Goods

Packaging

Furniture

COMPANY NAME

ADDRESS

TEL / FAX

PRODUCT GROUP(S)

NAME / POSITION OF INTERVIEWEE

DATE / TIME OF INTERVIEW

1.0 How long has the present company been in existence?

1.1 How many people does the company employ?

<input type="text"/>
<input type="text"/>
<input type="text"/>

Group
Company
Division

1.2 Does the company have a research, design and development department (specify any relevant details)

☐

YES

☐

NO

1.3 How many people are employed within this department /sector?

RD&D

1.4 Do you have a project development team(s)?

☐

YES

☐

NO

1.5 Which disciplines are represented within the team(s)?

1.6 Approximately, how many people are involved in the design process?

1.7 Are these employees trained?

	YES	NO
designers	<input type="checkbox"/>	<input type="checkbox"/>
engineers	<input type="checkbox"/>	<input type="checkbox"/>
material engineers	<input type="checkbox"/>	<input type="checkbox"/>
marketing personnel	<input type="checkbox"/>	<input type="checkbox"/>
financial personnel	<input type="checkbox"/>	<input type="checkbox"/>
other (specify)	<input type="checkbox"/>	<input type="checkbox"/>

1.8 Describe the main products or product areas that the company deals with from development through to manufacture (and sales).

1.9 Are any of these areas new product areas or are these fairly established groups within the company?-specify

2.0 Do environmental issues affect any aspect of the company practice?
☐ **YES** ☐ **NO**

Expand

Is this likely to change in the future?

2.1 Would you say that there is a general environmental awareness within the company?
☐ **YES** ☐ **NO**

2.2 Does the company have a formal environmental policy?
☐ **YES** ☐ **NO**

Briefly describe main points

2.3 Does the company have an informal (spoken) environmental policy?

☐ YES

☐ NO

Briefly describe what this is

2.4 Is the company part of a group?

☐ YES

☐ NO

Does the group have a formal environmental policy?

☐ YES

☐ NO

Briefly describe main points

2.5 Is the company affected by a customers / suppliers environmental policy?

☐ YES

☐ NO

Specify

2.6 Is the company aware of an Industrial Association environmental policy / initiative?

☐ YES

☐ NO

Specify

2.7 Does the company employ methods / considering employing methods to analyse the environmental impact of the company's business behaviour?

☐ YES

☐ NO

Specify

2.8 Is the company aware of present or impending environmental legislation, voluntary guidelines..., that may affect the products the company manufactures?

☐ YES

☐ NO

Specify

2.9 Is the company taking action because of present or impending environmental legislation, voluntary guidelines....?

☐ **YES** ☐ **NO**

Specify

3.0 Is there current (re)design and development of 'green' products within the company?

☐ **YES** ☐ **NO**

Which products?

3.1 Is it likely that there will be future (re)design and development of products because of environmental impacts?

☐ **YES** ☐ **NO**

Expand

3.2 Does the company see being environmentally aware as a competitive advantage?

☐ **YES** ☐ **NO**

Why?

3.3 Would the company use the fact that they were environmentally aware in the marketing of their products?

☐ **YES** ☐ **NO**

Why?

Contact again

☐ **YES** ☐ **NO**

ECODESIGN: Analysis of environmental factors in the product design and development process.

Questionnaire Number

COMMERCIAL- IN CONFIDENCE

COMPANY NAME _____

DIVISION NAME _____

ADDRESS _____

TEL / FAX _____

NAME OF INTERVIEWEE(S) _____

POSITION(S) IN COMPANY _____

DATE, TIME & PLACE OF INTERVIEW _____

Background Information

Could I begin with asking you to give me a brief history of the company, such as:

1.1 When was the company founded?

1.2 What is the status of the company?

UK owned dependant company

Part of UK owned group

(please name parent group)

Part of overseas owned group

Other (specify)

1.3 Does the company have a R&D / Design department

How many people work in the design / R&D department?

Full-time?

Part of another job?

Of these, how many are trained designers?

What qualifications do these designers have?

1.4 Could you describe the main company business ~ in terms of its products and its markets.

1.5 Could you tell me what percentage of your product sales is exported?

%

What are the main countries for export markets?

1.6 Could you tell me the most recent approximate value (£000) of total turnover for this company / division as listed in your most recent annual report?

Company £ 19

Division £ 19

THE DESIGN PROCESS

Important to get real 'ecodesign' examples (visual if possible) Might be better to try and focus down on one or two product examples in this section - to get a story from those involved....

2.1 What forms of internal or external pressures are there for incorporating an environmental perspective in product design and development? Grading 1 - 3; 1= not likely , 2= likely, 3= very likely. Ring appropriate number.

Regulations	1 2 3	Existing	1 2 3	Anticipated	1 2 3
Standards (BS7750)		1 2 3			
Customers Direct (retailers)		1 2 3			
Rival Products (on market)		1 2 3			
Potential Rival Products		1 2 3			
Suppliers		1 2 3			
Environmental Pressure Groups		1 2 3	Campaigns:	Local	Y N
				National	Y N
Financial		1 2 3	Insurance	Y N	
			Investment	Y N	

New Technology	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3
Change in Company Policy	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3
Pressure from Employees	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3

Notes

*In order to answer the following questions it would be helpful to focus down on one or two products that have been designed to satisfy environmental criteria. (These can be 'redesigns' or 'new to the world' products)

Name of Product(s) : (1) (2)

Would like to look at the ways in which the development of new products or redesign of existing ones has been affected by environmental pressure on the company.

2.2 Could we begin by taking each stage of the design process for product X and seeing where changes needed to take place in order to accommodate environmental pressures.

For example, we have the product planning / design brief stage were there any changes that needed to be taken on board at this point due to environmental factors and what were these? *(go through list like this)*

Stage of design process	Change to accommodate environmental pressures	What change(s)? How was it implemented?
-------------------------	---	---

Product Planning

<input type="checkbox"/> Y	<input type="checkbox"/> N
----------------------------	----------------------------

Design Brief	<input type="checkbox"/> Y	<input type="checkbox"/> N	
Product Specification	<input type="checkbox"/> Y	<input type="checkbox"/> N	
Conceptual Design	<input type="checkbox"/> Y	<input type="checkbox"/> N	
Detail Design	<input type="checkbox"/> Y	<input type="checkbox"/> N	
(incl. material choice / manufacturing processes)			
Manufacture	<input type="checkbox"/> Y	<input type="checkbox"/> N	
(Incl. design for manufacture and disassembly)			
Sales	<input type="checkbox"/> Y	<input type="checkbox"/> N	

Notes

2.3 How does this product's development differ at various stages of the design process from a comparative non-green product that hasn't been influenced by environmental concerns?

2.4 What barriers / opportunities are there for the introduction of environmental criteria into the design process?

2.5 To date what environmental impacts have been considered in the development of products at X?

Grading 1 - 3: 1(i)= never 2(ii)= sometimes, 3(iii)= usually

Product 1 = 1 2 3

Product 2 = i ii iii

Environmental Impact

Energy Efficiency	<div>123 * i ii iii</div>
Energy Conservation	<div>123 * i ii iii</div>
Renewable Energy Source	<div>123 * i ii iii</div>
Reduction in Material Usage	<div>123 * i ii iii</div>
Recycled Materials	<div>123 * i ii iii</div>
Renewable Materials	<div>123 * i ii iii</div>
Design for Durability, Repair or Maintenance	<div>123 * i ii iii</div>
Design for Reuse, Remanufacture, Recycling	<div>123 * i ii iii</div>
Reduced use of Toxic, Hazardous or Ecologically Damaging Materials or Chemicals	<div>123 * i ii iii</div>

Notes

2.6 Have there been attempts to assess environmental impacts of product over the whole life cycle?

Y

N

Has this been carried out using specific techniques?, eg. LCA
Energy analysis?

2.7 Is new or difficult information required for environmental issues to be addressed within the product development process?

☐ Y☐ N

2.8 Is information needed at different stages of the design process:-

Design Brief	<input type="checkbox"/> Y	<input type="checkbox"/> N
Concept Design	<input type="checkbox"/> Y	<input type="checkbox"/> N
Detailed Design	<input type="checkbox"/> Y	<input type="checkbox"/> N
Manufacture	<input type="checkbox"/> Y	<input type="checkbox"/> N
All	<input type="checkbox"/> Y	<input type="checkbox"/> N

Is information needed to tackle different approaches to green design ;

Energy Efficiency	<input type="checkbox"/> Y	<input type="checkbox"/> N
Energy Conservation	<input type="checkbox"/> Y	<input type="checkbox"/> N
Renewable Energy Source	<input type="checkbox"/> Y	<input type="checkbox"/> N
Reduction in Material Usage	<input type="checkbox"/> Y	<input type="checkbox"/> N
Recycled Materials	<input type="checkbox"/> Y	<input type="checkbox"/> N
Renewable Materials	<input type="checkbox"/> Y	<input type="checkbox"/> N
Design for Durability, Repair or Maintenance	<input type="checkbox"/> Y	<input type="checkbox"/> N
Design for Reuse, Remanufacture, Recycling	<input type="checkbox"/> Y	<input type="checkbox"/> N
Reduced use of Toxic, Hazardous or Ecologically Damaging Materials or Chemicals	<input type="checkbox"/> Y	<input type="checkbox"/> N

2.9 Has change in the product development process, as a result of environmental pressures, resulted in increased collaboration with;

customers	<input type="checkbox"/>
suppliers	<input type="checkbox"/>
competitors	<input type="checkbox"/>

Notes

2.10 How successful has the greener product you have described been?
Grading 1 -3: 1=not successful, 2= no noticeable change in success, 3= very successful.

Commercially	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3
In technical and design terms	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3
In terms of consumer / user satisfaction with the product	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3

2.11 Do you consider that environmental issues will restrict the creativity of the designer at any stages of the product development process?

☐ Y

☐ N

2.12 Do environmental issues provide opportunity for designers to exercise greater creativity at any stage of product development?

☐ Y

☐ N

2.13 Some people say that the design of 'greener' products is a short term answer to dealing with a passing green trend. What is your reaction to this?

2.14 What are the implications of greener products for manufacturing processes, methods of marketing etc.?

2.15 Do environmental factors challenge the ethos of design as we currently know it? (quantity vs quality; market-led vs longer life...)

2.16 Do you feel that designers can play an important role in reducing the environmental impacts of products? ☐ Y ☐ N

If so, what is required by the designer for this to be practicable?

If no, why not?

2.17 What is the best 'greener' product(s) of the type(s) you have described and who makes it (them)?

Who do you consider to be the environmental benchmark companies involved in design and development in your own or in other industries?

For what reasons do you think this?

ENVIRONMENTAL POLICY

Does your company have an environmental policy? ☐ Y ☐ N

If NO ask if they are in the process of implementing one - some of the questions. below can be applied ()*

If YES, Is this a written formal policy or informal policy?

☐ FORMAL ☐ INFORMAL

(If a written policy, would it be possible to have a copy of the policy document?)

i)Please describe the main objectives of this policy. (would it be possible to have a copy of this?)

ii)What are the reasons for your company implementing an environmental policy -

If you had 3 main drivers making you take action on environmental issues what would they be?

Reason 1

Reason 2

Reason 3

Examples - Are any of the following reasons applicable?

- ☐ a response to anticipated / actual environmental regulations?
- ☐ corporate social responsibility?
- ☐ corporate image
- ☐ commercial advantage
- ☐ pressure from customers / employees
- ☐ other (specify)

Notes

(*)What would be the reasons for company to implement an environmental policy -
For designers ... might be useful to prompt by asking 'from your own experience of product development is there any particular reason for implementing an environmental policy?'

3.2 Which sections of the environmental policy are of particular relevance to this department / division? Please explain why.

(*)What sort of environmental issues would be of particular relevance to this department / division?

3.3 Who in the company / division / department is (would be) accountable for ensuring that these policies are successfully implemented? (Job title)

Company_____

Division_____

Department_____

3.4 What operations within this department need to be re-addressed with environmental issues in mind?

3.5 Does the company environmental policy or other pressures to tackle environmental issues give rise to a need for environmental education and training in the company?

☐ Y

☐ N

If YES,
Is an environmental training program practised / being considered in this department / division? What does / will this entail?

If NO -Why?

3.6 Have employees within this department / division brought about changes in practices that were ‘environmentally risqué’ by placing pressure on management?

☐ YES

☐ NO

If YES,
What were these changes?_____

What was the company's reaction to this?_____

Is this encouraged within the workplace?_____

Further notes on interview:-